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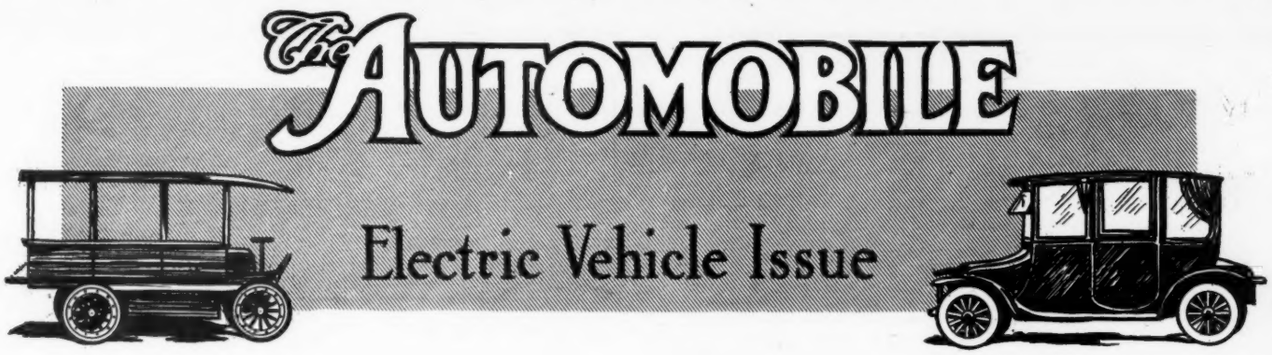
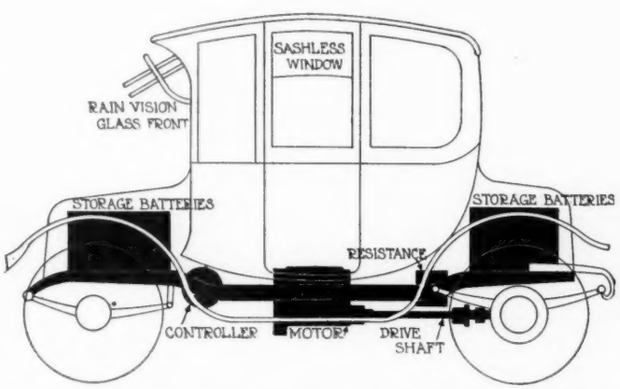


Conserving Batteries Is Object of Vehicle Makers

Makers of Electric Passenger Vehicles and Trucks Vie in Reducing Friction Losses To Increase Battery Mileage—Many Improvements But Few Radical Departures —Industry Shows Steady Growth

PRODUCTION of electric vehicles this year approaches 8,400, of which number 5,000 have been passenger vehicles, and about 3,400 commercial types. Statisticians placed the total number of electrics in use in America at the first of the year at 30,000, a generous estimate, so that today the grand total reaches 38,000, a good, round number when it is remembered that at the beginning of this year the total number of cars in Germany was but 60,000, there being today more than one-half as many electrics in this country as the entire German total.



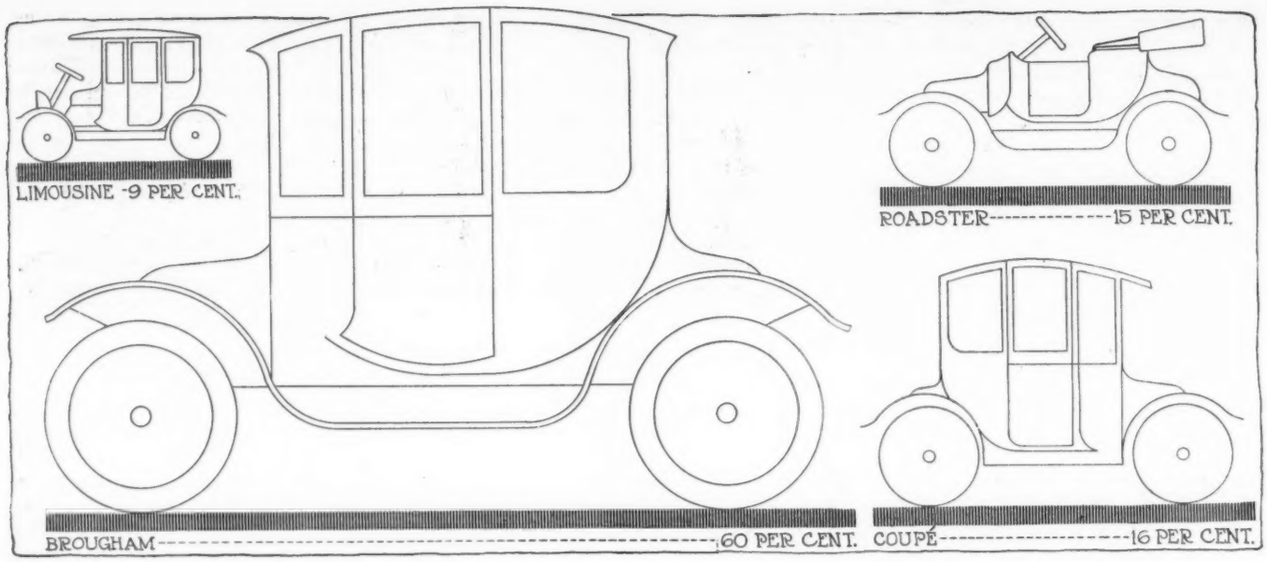
Type electric for 1914 illustrating the most popular features found in the new models. It is a five-passenger brougham with lever steer, rain-vision glass front, sashless windows and 34 x 4-inch cushion tires. All passengers face forward. The specifications of this car include: an I-beam front axle; full-floating rear axle with a pressed steel housing; a 40-cell lead battery, half in front and half in the rear, and motor suspended amidships with double reduction shaft drive. The wheelbase is 100 inches. The general scheme of the average electric car for 1914 is shown in the above illustration

Pushing the Boundary Lines

The growth of the electric over much of the country has been rapid during the past year. It has not been of the boom nature, rather a conservative increase, an increase measured by the capacity of the producers. Electric vehicles, considering passenger and commercials as a unit, have grown over 45 per cent. in New York city during the last 2 years; Chicago estimates its increase in electric trucks at 400 per cent. during that time; St. Louis has in the last year had a heavy increase, perhaps over 30 per cent. In Boston the electric truck has grown remarkably, showing a gain of 65 per cent. during the last year. Washington, D. C., has 250 trucks in operation and the business is doubling each year; in Pittsburgh, the electric truck has taken hold within the last few years, and although there are scarcely two-score trucks in use today five times as many have been sold this year as last; Denver has approximately sixty trucks and business may be doubled next year; Los Angeles has two-score trucks with a rapidly increasing business; Philadelphia, with six dealers of electrics, has approximately 500 trucks working, and prospects bright for a 50 per cent. increase next year; and in the smaller cities such as Indianapolis with seventy-five, Louisville with forty-five, Minneapolis with forty, and other cities of similar size with like numbers, it is certain that the electric both commercial and passenger types will make steady progress during the coming season.

Further statistics show how the electric movement has gained. Two years ago New York City had 1,200 vehicles, mostly trucks; today the city has more than 2,200. It has over 1,800 commercial vehicles.

In May 1912 there were registered in Massachusetts 514 electrics, a year later there were 833, a gain in the year of 62 per



A glance at this illustration shows that the electric is pre-eminently the car for the luxury loving class, as all but 15 per cent. of the models offered this year are closed. The brougham is the most popular model, three out of five cars being of this type

cent. Of this total, the gain in passenger vehicles was 45 per cent., the gain in commercial vehicles 93.7 per cent.

New England s Heavy Gains

The registration in New England for the first 5 months of 1913 ending May 31 show a total of 1,110 machines of all types in the six states. Of this total 726 were passenger, and 384 commercial. Massachusetts and Connecticut make up the great percentage of these. The figures show totals as follows: Maine six, New Hampshire thirteen, Vermont three, Massachusetts 833, Rhode Island twenty, and Connecticut 235.

Going to the other side of America, a growth of electrics similar to that witnessed in the East is taking place, this being particularly true in Southern California. Current is cheap and there are many charging stations within 50-mile radius of such cities at Los Angeles.

One fact which augurs well for the increased sale of electrics for 1914 is the rapid extension of selling agencies into cities of 50,000 population and over. This work has only begun, and when it is well under way it will become a question of production to meet the demand. In many of these cities street pavements are better than in the larger cities, furnishing ideal conditions for electric operation. A slight example of the merchandising capacities of various cities may be obtained from the following cities. At present Chicago has seven dealers handling electric commercials and more than this number handling passenger cars. Boston has eleven truck agencies; Denver has seven; Philadelphia has six; Indianapolis has eight; Louisville boasts of two; in Omaha there are three; Hartford, Conn., with but two dealers, has forty-eight electric trucks; and so the story goes. When cities of like capacity have their adequate force of electric selling agencies, the countrywide impetus of the movement will be felt.

New York City Growth

In New York City where the sale of electric trucks is pushed perhaps stronger than in any other city, there are in use approximately 1,700 electric trucks this representing an increase of over 300 during the present year, and with some large sales recorded at the opening of the show it is a conservative estimate that this number will perhaps be increased 100 to 150 before the end of the year. In New York City the central station interests are doing excellent service, as has the Electric Vehicle Association of America, and it is only when these interests work in harmony with the efforts of the manufacturer and dealer that the best results are obtained.

The status of the electric manufacturing field is approximately the same as 1 year ago, there being approximately twenty active concerns in the production of both passenger and commercial vehicles.

Vehicle Association's Active Work

The good work of the Electric Vehicle Assn. of America, which organization was started 4 years ago, is being continued, the organization now boasting of 430 members, an increase of 35 per cent. during the last year. Its activities are country wide; its one object is that of drawing attention to the various fields of activity of the electric vehicle as well as furthering the good of the industry in every particular line.

One other organization that has done good service for the promotion of the electric vehicle is the Boston Electric Motor Car Club, which, with a membership of 120 is doing good service for the industry in the New England territory.

Progress in Construction is General

The story of progress made during the last year, or rather as exemplified in the 1914 models of passenger cars and trucks, is a more comprehensive story than has been told for several seasons in the electric field. The story is one of activity, a real get-down-to-business story, a production story with some makers, and in nearly every case a story of better material, improved batteries, and general refinements.

Some makers have re-vamped their line of passenger and commercial vehicles from start to finish, and generally the greatest activities are found with the biggest producers, certainly a healthy condition. There are not a few concerns who point with apparent pride to the fact that they have not to make any changes, that their vehicles as brought out some seasons ago are as near perfect as can be made, fortunately, however, these are few.

Batteries More Accessible

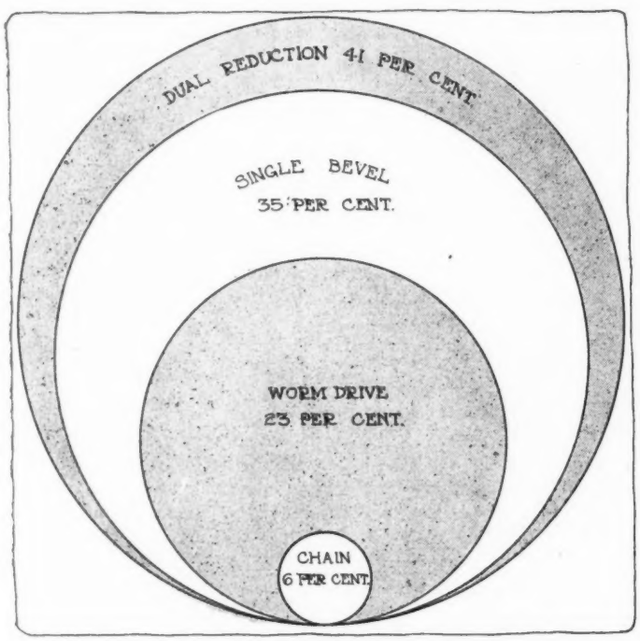
As the battery is the life of the electric vehicle, it is but proper to look at its improvements. The same general battery design in the lead and nickel types are continued, but refinements have been made, particularly in the lead types, which are in general use with the passenger vehicles. The thin plate battery has come in real force. With it the number of plates per cell is increased; where eleven plates are used this year, thirteen or perhaps fifteen are being used next year. The greater number of plates gives increased battery capacity without adding weight; in some cases the makers claim, a slight reduction in weight in spite of the

added capacity. With a thin plate a stouter grid construction is used, and in some cases the cohesive and adhesive qualities of the filling mixture have been improved. The chemistry of the filling material has also been improved to give additional efficiency.

With lead types, the no-wash cell has made rapid strides. This type of cell, in which the mud space below the grids has capacity to accommodate all of the active material in the grids, adds only indirectly to the battery efficiency in that it eliminates any possibility of the disintegrated material collecting against the bottom of the plates and so interfering with chemical action. With the new no-wash cell it will not be necessary to do any washing for the removal of this disintegrated material during the life of the cell.

Larger Battery-Carrying Spaces

From the vehicle manufacturers' viewpoint conditions for the battery have improved materially. In the passenger vehicle line



A comparison of the drives for 1914 reveals the fact that the dual reduction type is in the lead, its percentage of the total being 41. Single bevel drive is almost as popular with 35 per cent. Worm drive is seen on 23 and chain on 6 per cent.

the battery is generally more accessible, and where manufacturers have in the past persisted in carrying a few of the cells under the seats, a most inaccessible position, they are now carrying them all under the hoods of the battery-carrying space, so that with these hoods raised every cell becomes accessible. This is desirable in that it insures the battery inspector adding the necessary water to bring the electrolyte to a required level in the different cells; it also insures daily inspection of all the connections; and it makes it possible to test the cells and, in a word, see that the battery gets that daily attention which is necessary for long life.

In the commercial vehicles, the trend of battery improvements has been rather that of mounting the cells in smaller-capacity trays, and mounting these trays on cradles with rollers so that they can be readily withdrawn for inspection purposes. This means better daily attention and longer life.

Battery compartments are being made more weather-proof, thus protecting the battery from splashing water and dripping through the load platform. In some cases sheet metal covers for the battery compartment are provided with necessary wood insulation to protect the cells from short-circuiting.

In general the vehicle manufacturers are equipping a little more battery capacity, so far as ampere-hour reckoning is concerned. More judgment is being used in the battery equipment, particularly for commercial vehicles, and in large installations the question of battery equipment is determined by experiments extending over several weeks, or perhaps a month. In a word, the object is to adapt the vehicle to the work rather than compel the work to adapt itself to the vehicle. The number of cells carried depends on the mileage required, the speeds demanded, and the physical characteristics of the locality. These conditions often decide whether nickel or lead batteries should be used.

Because of this requirement for different battery capacities, many of the makers are building oversize compartments for carrying the battery, these compartments having capacity for the largest equipment needed.

Pages from Makers' Programs

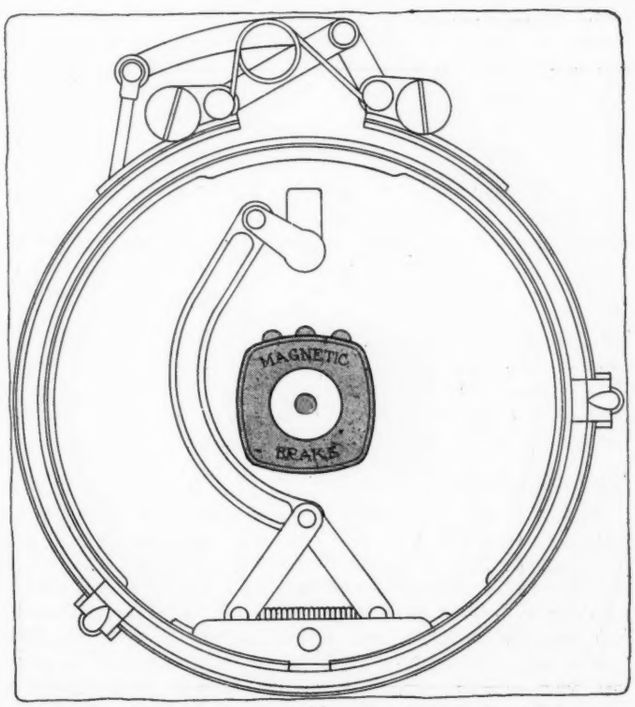
A few examples from the note books of manufacturers will show how they are wrestling with the battery question: The Baker company is mounting the battery more accesibly in order to facilitate inspection and repair. Its battery equipment is varied according to mileage, speed, and characteristics of locality. The company is fitting a charging switch independent of the running switch. In its passenger vehicles all batteries are under the hoods and none under the seats.

In the new Anderson commercial the battery is divided in trays, one tray under the chassis at the right, the other beneath the chassis at the left. The trays are carried in cradles mounted on rollers. Metal battery compartments are used of capacity equal to the largest equipment needed.

The Waverley company has aimed at standardizing on 42 cells as compared with 40 this year, and has adapted its compartments to take 60 cells of Edison equipment. In its passenger vehicles the compartment is rubber lined to prevent leakage.

Dual Control Is Here

In an analysis of the progress of electric passenger vehicles dual control is one of the talking points, by dual meaning ability to drive either from the front seat or the rear seat, generally two entirely distinct sets of steering and controlling pedals and levers being provided. Where the dual control is listed it is generally



Showing the relative numbers of cars equipped with two sets of mechanical brakes and those with one mechanical and one electrical set; 77 per cent. in the one case and 23 per cent. in the other

confined to one model or two at the most, and these models are invariably five-passenger broughams, limousine types or designated in some cases French coach designs.

Cutting Out Chassis Friction

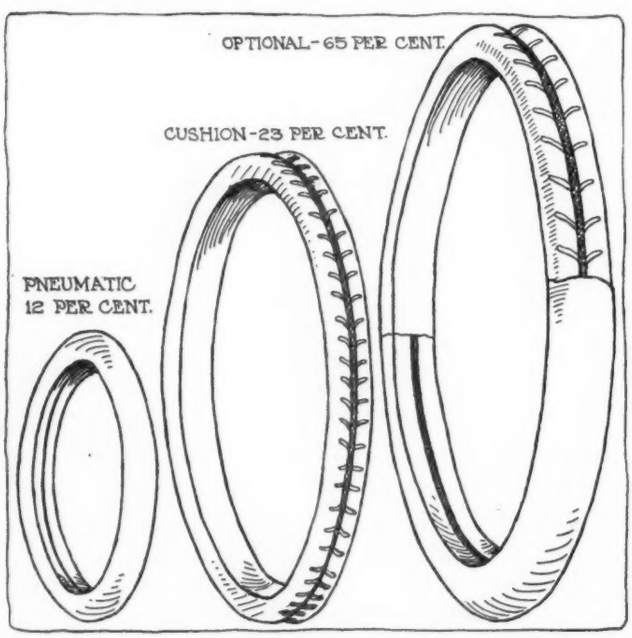
Chassis refinements include better anti-friction bearings for carrying front wheels as well as for general use in the rear axle. Many concerns point to the use of double-row annular ball bearings or to new types of roller bearings and invariably add that these bearings give easier riding and so conserve the battery current and thus give a greater radius of mileage without adding to the battery size. These same makers draw attention to the use of ball or roller bearings in the steering gear.

With larger vehicles and in some instances faster ones it is essential that brakes be larger and more positive. The majority of the companies have made them larger, the drums greater in diameter and the brake shoes wider. One set is invariably put on the rear wheels and if present tendencies are continued it will not be long before fitting two sets of mechanical brakes on the rear wheels will be as general in the electric field as in the gasoline field. Pedals are generally used for brake application, one pedal having a ratchet arrangement and serving to lock the vehicle much as does the lower emergency brake on a gasoline model. This emergency brake is very frequently interconnected with the current so that its application cuts out the current making it necessary to bring the controller lever back to neutral before making any speed possible.

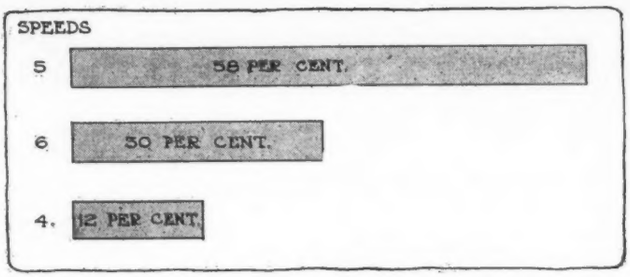
Speeds in miles per hour are not any higher, on the average, than they were this year. Twenty miles per hour is the general speed, although one maker schedules 25 and others 22 and 21. In one model a fifth position is provided on the controller giving 22 miles per hour but it is necessary to hold the controller lever for this position and once the hands are off the lever automatically comes to a lower position giving 20 miles per hour.

Deep Upholstery Featured

Interiorally the 1914 vehicle is a little more palatial than this year. The upholstery is deeper, the proverbial 8 or 10-inch seat cushions now being heard of in several places. Backs of seats are plain rather than tufted and where sides and ceiling are cloth or leather covered the plain covering is more general. Bedfords and whipcords are leaders in interior finish, although



Pneumatic or cushion tires are optional on the majority of electrics for the coming season. Cushion tires are twice as popular as pneumatics, judging from the equipment of those cars on which no option is offered



Three-fifths of the cars are equipped with five speeds forward, three-tenths have six, while those with four are not much over one-tenth of the total

Spanish and other leather styles have a good following. The fitting of speedometer is much more general than formerly and wherever fitted an effort has been made to subdue them by mounting flush with the wall face. Clocks are becoming accepted equipment and vanity cases, vases, etc., are still in general use.

Four Adopt Worm Drive

The chassis in not a few makes has been quite re-vamped during the last 12 months. Uppermost in this respect is the more general use of worm drive, four companies: Rauch & Lang, Anderson, Baker and Fritchle having taken it up and joined the ranks of Tiffany, which was a leader in this form of rear axle transmission. With the worm-driven axle it is possible to use a relatively high-speed motor, one with 1,500 revolutions per minute and still use but a single gear reduction between the motor and the rear wheels. Anderson mounts the worm beneath the axle and R. & L. above the axle.

Shaft drive is almost universal, only one company listing chain drive on its regular models, that being Bailey.

Window Space Increased

More window space is generally apparent, this being accomplished by larger glass area, a desirable safety factor in these days of increased traffic and greatly increased use of motor vehicles. In some makes the actual window space has not been added to but using sashless windows has resulted in practically the same.

Before leaving the window aspect, attention is invited to the improved methods of clear-vision fronts, one of which is the Hanlon patent used on the Detroit vehicles and apparent adaptations of which are seen on other makes. This device consists of two glasses forming the upper half of the glass front of the body. One is outside of the other, and if both were closed there would be an air space about an inch wide between them. The two sashes can be tilted or swung forward. The outer one forms an inclined shield for sleet or snow and the inner one can remain closed, or both can be opened. This double-glass idea really gives a clear-vision front for rains or snowstorms and greatly adds to the all-round utility of the vehicles.

Improvements in Trucks

The story of the electric commercial vehicle is in many respects the same as the electric passenger car, it being but natural where concerns are building both types that the improvements of one be incorporated with the other.

Few makers have added to the number of models listed this year, and where additions have been made they have generally come in the 1,000-pound type of vehicle. Two or three new ones have been added in this class, and they are generally of the worm or bevel driven types.

In the chassis, pressed steel frame constructions are becoming more general, and these, in nearly every case, are of the bottleneck pattern, narrowed in front, making it possible to maneuver the vehicle in closer quarters. It consumes electric current in reversing two or three times to turn in a narrow street and if frame improvements of this nature eliminates such maneuvering, then the battery is being proportionately conserved.

An A B C of the Electric Motor

Outline of Magnetic Principles Involved—Development of Drum Armature—Methods of Winding—Means of Control—Resistances

By Sydney Oxberry

Fig. 1—Totally inclosed motor for electric vehicle propulsion, by Westinghouse Co. The cover is shown removed for inspection of the brushes

ONE of the most remarkable features of the modern electric vehicle is the comparative ease with which it can be handled and run by people technically ignorant of its inner working. Every year has seen further development of the motor and controlling apparatus in the direction of rendering driving an extremely simple matter and attention scarcely necessary except that which can be easily given by the layman.

While this is true there must still be a large proportion of owners of electrics with sufficient curiosity to see that the pleasure derived from running their machines would be much enhanced if they had the electrical knowledge necessary to comprehend the details of operation. All drivers of gasoline cars are aware of the great practical value of a technical knowledge of the processes that take place between the gasoline tank and the road wheels. However slight this knowledge, the owner is so much more capable of meeting mechanical difficulties and therefore less dependent on the repairer.

With the gasoline engine, though its present state of development is one of the wonders of engineering, yet an elementary study of its action that will be useful is a comparatively simple matter. The essentials of operation are such that they can be comprehended from the beginning. This is the particular in which electric motors and electrical apparatus in general show a decided difference. At the very beginning a study of them seems to present to the ordinary mind such obstacles that the average owner of an electric takes it for granted that he must be content to continue running his car with a knowledge only of how to move the control handle to obtain the different speeds and the pedals to stop it. These difficulties are largely imaginary and the following is an attempt to show simply the method of operation of the electric motor and controller as fitted to the electric vehicle of today.

Elementary Considerations

The electric motor consists essentially of: 1, a magnet, and 2, a series of electrical conductors wound on an iron armature that is capable of rotation in the magnetic field of the magnet. Mechanical energy is produced from the electrical energy applied to the conductors on the armature by means of magnetic attraction and repulsion taking place between the field magnet, which is the stationary one of these two members, and the free armature.

Beginning with the ordinary horseshoe magnet A, Fig. 2, it is common knowledge that any piece of iron or steel coming within range of the two poles is immediately attracted thereto. It is not so generally known, however, that before this attraction can take place the piece of iron presented must itself become a magnet. Any magnet can induce magnetism in a piece of iron in its proximity, and this process always precedes attraction.

If the north pole of a magnet, generally marked N, as shown at A, is brought near to a compass needle the south end of the needle is strongly attracted. If the other pole of the magnet is presented, the north end of the needle swings round similarly by attraction until it occupies a position which is the shortest possible distance from the magnet pole. On the other hand, if the N pole of the magnet approaches the north end of the

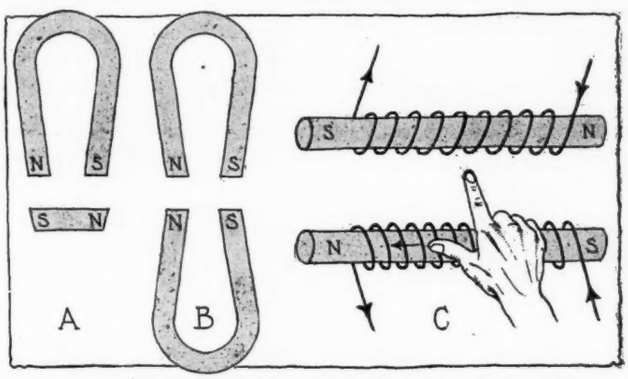


Fig. 2—Demonstrating the fundamental law of magnetism. A shows attraction. B shows repulsion between two magnets. C illustrates the hand method of determining the polarity of an electro magnet from the direction of the current

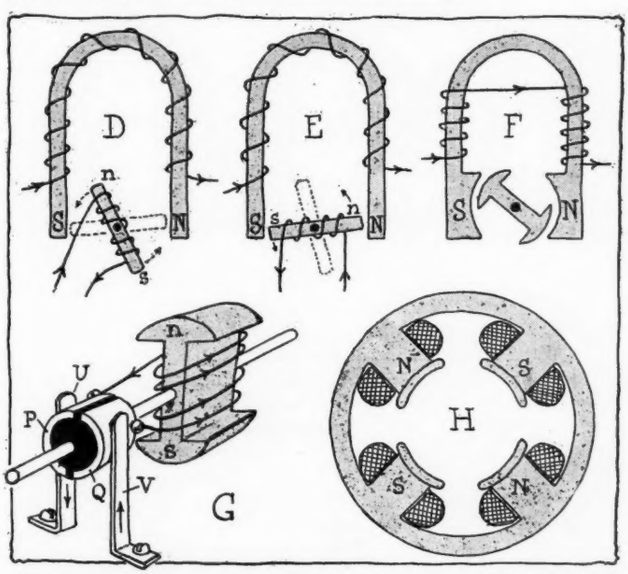


Fig. 3—Evolution of the electric motor from simple magnetic forms. The larger magnet in D E and F represents the field magnet, and the smaller one, n s, the rotating armature. G, two-way commutator and shuttle armature. H, four-pole field magnet

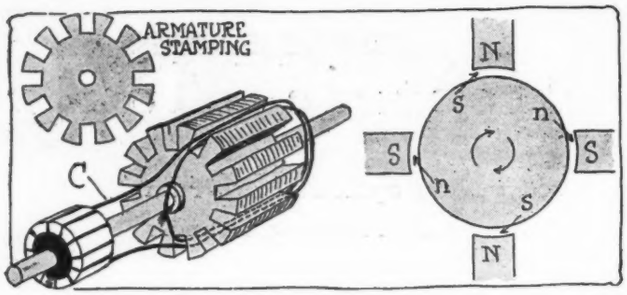


Fig. 4—Left, construction of laminated armature from soft iron stampings and method of winding in slots and connecting up to commutator. Right, diagram illustrating the magnetic pull exerted by the four poles of the field magnet on the armature

needle an immediate repulsion is set up. The same action occurs when the two south poles are brought together. This demonstrates the fundamental law of magnetism: **Unlike poles attract each other. Like poles repel each other.**

When a piece of unmagnetized iron is brought in proximity with the poles of a permanent magnet the induced magnetism set up is always in the direction indicated at A, that is, the end of the iron nearest the N pole becomes a south pole and the other end a north pole as shown. This accounts for the attraction. A simple experiment which demonstrates the repulsion of like poles is shown at B. In this position the two magnets, if of approximately equal strength, will be found to exhibit no attraction, while if one is reversed they will immediately snap together.

The foregoing has dealt with permanent magnets only, such as those in use on the ordinary magneto for automobile engines. They are made of specially hardened steel and on being magnetized retain their magnetism. But a much stronger magnet can be produced by passing a current of electricity through a coil of wire surrounding a piece of iron. And it is on the discovery of this fact that the operation of the electric motor rests.

At C, Fig. 2, such an electro-magnet is shown. On current being passed in the direction of the arrows around the coil of wire the iron bar at once becomes magnetized with the polarity as shown by N and S. In the same illustration a simple method of determining the polarity of the induced magnet is shown by the so-called hand rule. In this the right hand is applied to the coil in such a way that the fingers point in the direction of the current. The extended thumb will then indicate which end of the iron will be north.

Applying this rule to the two magnets, C, it will be seen that attraction will at once take place owing to the unlike poles being adjacent.

Motor in Simplest Form

A similar pair of electro-magnets, except that one is larger and of horseshoe shape is shown at D, Fig. 3. Imagine the smaller one of these n s to be pivoted at the center so that it can rotate. If, now, current is passed around the coils in the direction shown, the polarity of the two magnets will be as indicated by N S and n s, and rotation will proceed by attraction in the direction of the small arrows until n s, which represents the armature of the motor, occupies a horizontal position as shown by the dotted lines, with the unlike poles S and n, and s and N together. But if at this point the current traversing the smaller magnet is reversed in direction, the current on the larger one remaining the same, the conditions will be as shown at E. The polarity of the rotating member has now been reversed and the like poles being adjacent, repulsion is set up between S and s as well as N and n with the result that rotation will continue until the position at D is once more arrived at. This completes the cycle.

It will be seen that an impulse is given to the rotating member at every half revolution and it only remains to insert a reversing switch in the electrical circuit of the coil on n s to obtain continuous motion. This brought about the introduction of the rotating reversing switch, or commutator shown at G. It was also found that a much stronger effect could be produced if the poles, both of the horseshoe or field magnet as well as the rotating magnet or armature were enlarged as shown at F so as to reduce the air gap across which the magnetic attraction takes place. The resulting form of armature, commonly called the shuttle type is shown mounted on a shaft with the commutator at G.

The commutator consists of a short length of brass pipe cut longitudinally in two and the halves so formed, P and Q, fixed to a piece of ebonite or other insulating material. Both halves are insulated electrically from the shaft and from each other, and the two ends of the armature winding are attached as shown, one to each half. A pair of brushes U V are mounted so that they bear on the commutator surface at points diametrically opposite. These are connected to the battery so that the current flows along one and returns by the other. In the diagram the current enters by the brush V, passes on to Q, then through the coil, producing the polarity n s, and from there to the commutator half P and so to the return brush U. It will be evident that the current changes direction twice every revolution, entering alternately by P and then Q, and consequently producing the necessary reversals of polarity in the armature to obtain continuous rotation.

Drum Type Has Even Torque

A little consideration will show that a motor with a shuttle armature will not start if the armature occupies a position across the poles of the field magnet. This corresponds to the dead center in a single cylinder engine. To obviate this and also to make the starting torque more even the drum type of armature was evolved. For the same reasons and also that of compactness in construction, various forms of the field magnet have been developed. Motors are now made with field magnets having two, four or more poles. The type most used on electric vehicles is the four-pole as shown at H, Fig. 3. In this the field coils are wound and connected to produce alternate N and S poles.

Returning to the drum armature, a most important development that adds considerably to the efficiency of the motor is the use of soft iron stampings for the armature. The principal ad-

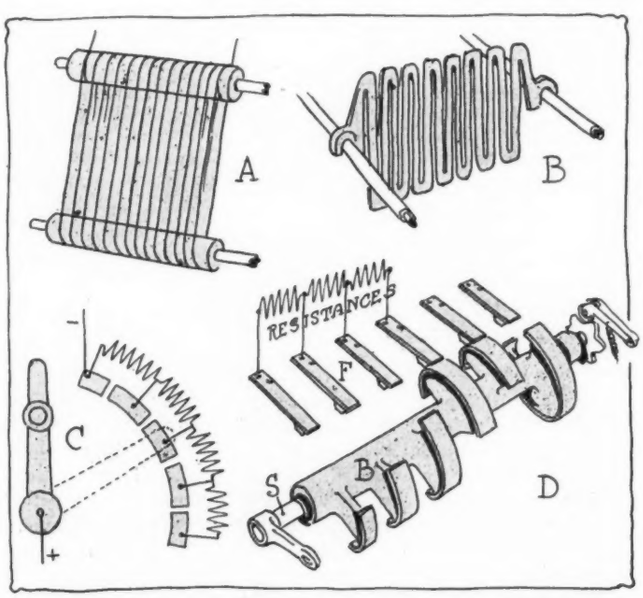


Fig. 5—Resistances. A, wire wound on porcelain insulators. B, single unit of cast iron grid resistance. C, rheostat for field regulation by insertion of resistance. D, barrel type of controller for motor

vantage derived from this laminated construction is that the repeated reversals of polarity which take place when the motor is running are thereby rendered much easier. The degree of magnetization possible is also greatly increased. Laminations are also used for the field poles in some motors.

The increase in the number of coils wound on the armature necessitates the use of a commutator with a corresponding number of segments. The connection between the shuttle armature and the slotted drum type, Fig. 7, may not seem very apparent. Reference to Fig. 4 will explain this. The wire is wound in a series of coils, each end of which is connected to a commutator segment. These coils are wound in such a way that one long side of each occupies a slot on one side of the armature while the other long side occupies a slot diametrically opposite. When completely wound the electrical system on the armature consists of a closed circuit, the beginning of one coil being connected to the end of the next at the commutator.

Brush Position Is Important

By certain connections to the commutator and position of the brushes it is possible to produce points in the circumference of the armature that could be termed the poles of separate magnets although there is no actual separation in the masses of iron constituting the different magnetic paths. The more the segments the smoother the action of the motor and the more even the starting torque. This point has an exact parallel in the operation of a multi-cylinder gasoline engine.

The positions of these imaginary poles in the armature mass are shown at n s in Fig. 4. If there is a large number of segments in the commutator these points will remain almost without movement though the armature itself is revolving at a high rate, and as a result there is a practically continuous pull exerted on the armature circumference at the four points.

A skeleton diagram showing the assembly of a typical motor is given at A, Fig. 6. In this the four field coils are shown in place on the magnet and the armature occupying the space between the poles. The connections indicated between the coils and commutator brushes represent one of several methods of wiring up a motor. This particular method is called series wound, since the current passes from one terminal through the armature windings and then through the four field coils one after the other to the other terminal.

At B the series method of wiring is shown in a simpler diagrammatic form. Other styles of winding are shown at C, D and E. The connections at C are those of a simple shunt wound motor. In this type the current divides at the entering terminal, some of it passing to the commutator brush and some around

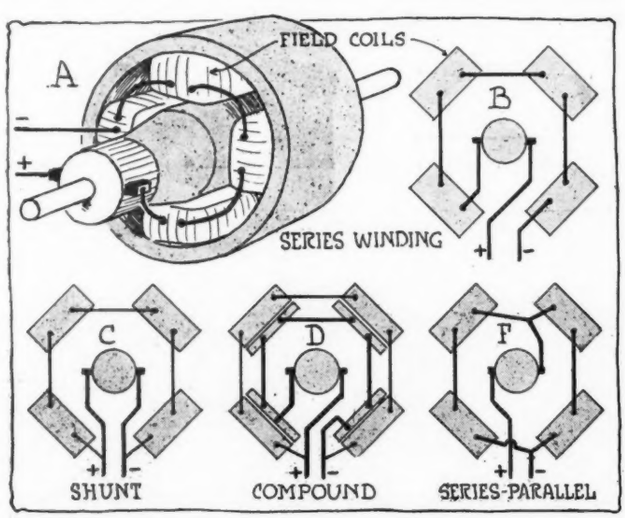


Fig. 6—Showing the various ways of connecting up the field coils and armature of an electric motor. Simple series winding is shown at A and B. In this the current flows in turn around the armature winding and then the four coils on the field magnet

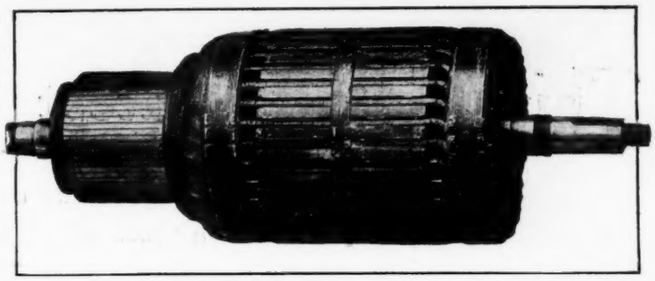


Fig. 7—Armature of Westinghouse vehicle motor, showing the winding occupying the slots and the method of binding by steel wire at each end of the coils and also in the center

the field coils returning to the other main terminal common to both circuits. This division of the current in the shunt motor has the effect of making the field strength absolutely independent of the armature speed and the applied voltage. In the series motor the current flowing in the field coils has a direct relation to the speed and resistance of the armature. Because of these peculiarities different methods of wiring are adopted according to the conditions and requirements of the motor. Thus a series motor is suitable where a high initial torque is required on starting. Series motors start easily on a heavy load.

Speed variation is obtained by altering the pressure of the current supplied through the introduction of resistances. Another method having a similar effect is to so connect the field coils that the current can be made to pass in series around all four or divide into two pairs. This is called the series-parallel method and some motors are connected up permanently in this manner, as shown at F, Fig. 6.

The wiring diagram at D shows a combination of series and shunt windings on one machine. This compound winding in certain conditions affords some of the advantages of both methods.

Methods of Controlling

As regards the control of electric motors, the two methods already mentioned, that of changing the field strength only by coupling of the separate coils, and variation of the current by the insertion of resistances in the external circuit, are the only ones practically followed.

Various metals and compounds, such as iron, German silver, etc., offer a high resistance to the flow of current, and lengths of these materials are made up in several compact forms ready for connection to controllers. When round wire is used as a resistance it is generally wound bare in coils on porcelain supports A, Fig. 5, and contained in a box or frame that allows a good circulation of air to play about the surface of the wire. This is necessary because of the generation of heat which always accompanies the passage of electricity along a conductor. In the ordinary lighting circuits the copper wire is of such a size and conductivity that the resistance offered is not enough to create heat. In a controller resistance the current passed is considerably greater, the full carrying capacity of the wire being more nearly approached. A later development of resistances, and one much used on electric vehicles on account of its compactness and constructional adaptability is the cast iron grid. B, Fig. 5. This allows mounting up on rods forming units of any desired length, and resistance. The connections are simply made by connecting eyes inserted between the grid lugs on the rod which is provided with nuts at each end for tightening up the whole set.

In order to provide for various amounts of resistance a controller is necessary. An ordinary form of controller for resistances is shown at C. This is generally called a rheostat. It will be seen that the resistance is virtually tapped at a succession of points and connections made to the switch contacts. By moving over the switch handle any number of steps can be inserted or cut out.

(*Continued on page 745.*)

Thin Plate Is Latest Battery Development

Construction and Operation of the Electric Vehicle Storage Battery—Comparison of Thick and Thin Plate Types

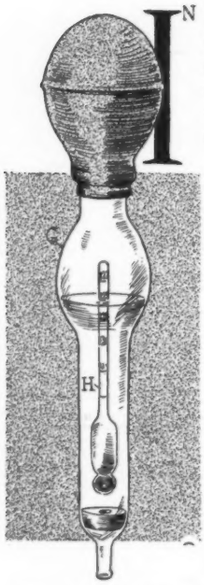


Fig. 1—Hydrometer used for testing storage batteries

IN CONSIDERING the storage battery, three factors in its efficient working stand out prominently. These are, first, maximum rate of discharge, second, capacity at various rates of discharge, and third, length of life. Maximum rate of discharge is necessary where large loads are to be met, such as the case of an electric vehicle climbing a long hill. High capacity is desirable to avoid too frequent visits to the charging depot, and length of life is an economical factor of importance in the running costs, by reducing the renewals. These factors represent the aims of battery designers ever since the accumulator was introduced, but especially since its immense possibilities in the automobile field became evident.

Before the electric vehicle made its appearance the storage battery had not progressed very far. Since nearly all batteries at that time were for stationary use there was no necessity for getting the most capacity out of every pound the battery weighed. When the battery had to provide power for the propulsion of a vehicle and carry itself at the same time, however, conditions were changed and the resulting efforts on the part of inventors have brought about the relatively light and compact storage battery in use today.

Before proceeding with the changes that have taken place and the present constructional methods in battery work it may not be out of place to outline briefly the essentials of the ordinary lead cell and the function of the constituent parts.

The batteries in use are divided into two classes: the lead-acid type and the iron-alkali type, the former being in the large majority. The essentials of the lead cell are two lead grids one of which contains a quantity of peroxide in the form of a paste and the other a quantity of finely divided metallic lead generally termed spongy lead. The peroxide plate is the positive and can be recognized by its dark chocolate color while the other plate, the negative, shows a gray surface. These are immersed in a cell containing a weak solution of sulphuric acid.

Acid Weakens During Discharge

In the operation of charging and discharging, chemical action between the plates and the acid takes place in a definite cycle which can be repeated until the plates are worn out. In discharging, when the cell is supplying power lead sulphate is formed on the plates, the positive yielding oxygen and the negative hydrogen. These two gases combine, forming water which dilutes the electrolyte gradually until the cell is completely discharged. On recharging both plates give up their sulphate and the acid is once more raised to its original density. These principles of operation are general and apply to all lead cells now in use. The differences in the various types are mainly those of construction and capacity.

The capacity of a battery depends on the area of active material in the plates exposed to the acid and this accounts for the placing of a large number of plates in a cell connected alternately to a positive and negative terminal, thus producing the same result as two very large plates. It will be seen also how the thickness of the plates has an important bearing on the plate area that can be obtained in a given sized cell. It is chiefly by the use of thin plates that the high capacity battery has been made possible. One of the reasons against the adoption of the thin plate was the difficulty of obtaining mechanical strength in a thin grid. With the older type of plate trouble was also experienced in so forming the grid that the active material would have no tendency to fall out when the cell was subjected to the constant vibration of the road. The negative plate in particular showed this defect and it is for this reason that it is customary to mix in the negative paste some expanding material that will counteract the shrinkage that takes place when in the cell. Even if there is no actual dislodging of the active material, shrinkage is a serious defect as a poor contact between the lead and the paste is thereby produced.

Staggered Grids Retain Paste

In the latest designs of grid the bars are staggered in such a way that there is no possibility of the paste falling out. Mechanically, too, the staggered plate is a decided improvement, allowing a much less weight to the same strength. Additional strength is also imparted by mixing a small proportion of antimony with the lead and casting under pressure. Sectional

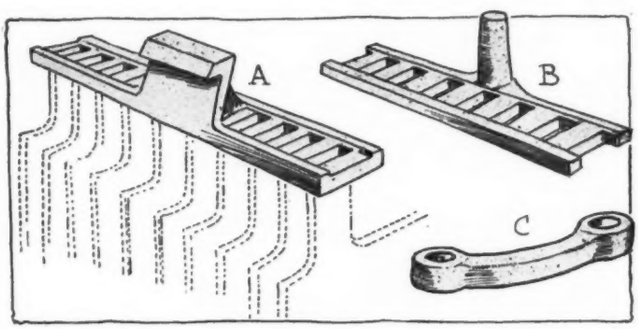


Fig. 2—Types of lead straps used to connect plates of battery

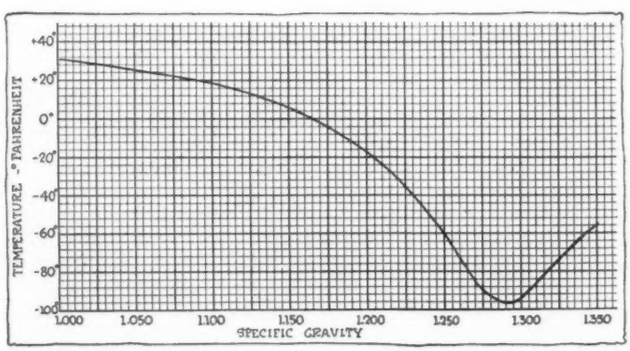


Fig. 3—Curve showing the freezing points of diluted sulphuric acid at various densities

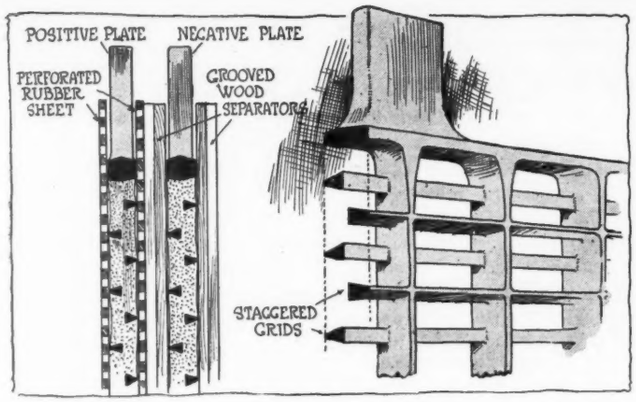


Fig. 4—Sections of typical grid, showing method of assembling

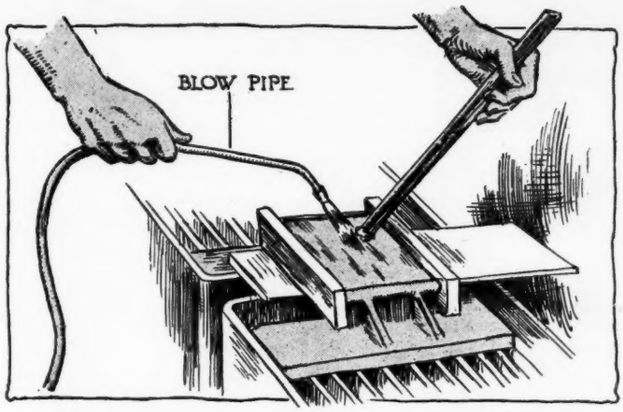


Fig. 5—Connecting the cells of a battery by lead burning

views of a typical grid are given in Fig. 4. This illustration also shows the approved method of separating the plates in a cell. Channeled wood specially prepared to resist the effects of immersion in the electrolyte is placed on each side of the negative plates, while perforated sheets of pure rubber cover the surface of the positives. These separators are carried well up above the edge of the plates to lessen the danger of short circuiting.

Negative Plate Area Greater

It is general practice to make up a cell with an odd number of plates, there being one more negative than positive plates. The plates are connected to the outer terminals by means of two lead straps one of which is burned to the lugs projecting from the positive and the other to those of the negative plates. In making up a battery of cells the two terminals are in turn burned to the terminals of the adjacent cell. This process of lead burning is shown in Fig. 5. Pure lead is used to form the joint and this is melted by a blow pipe flame. No acid or flux of any kind is used.

The two types of lead strap to which the plates are attached are shown at A and B, in Fig. 2. Where the pillar strap B is used the connection between adjacent cells is made by means of a connector C which is lead burned to the pillar terminals.

The cell jars are made of hard rubber a few inches deeper than the plates which they are to contain. Bridges of the same material formed integrally with the jar extend across the bottom and support the plates. The space underneath is necessary to receive the sediment which falls from the plates in service and which would otherwise bridge over between the lower edges of adjacent plates and cause a short circuit with serious results. A sudden discharge of this nature might ruin the plates by buckling. It is necessary to remove the plates and clean out this sediment once or twice in the lifetime of the battery except where a specially deep mud space is provided. Most battery makers supply such a cell with extra deep mud spaces, as well as their standard jar, so that where the space on a vehicle allows it the advantages of the deeper cell are available.

Vent Plug Carries Off Gas

After assembling the cells and charging, a hard-rubber top is put into place and sealed with composition. Each cell cover is provided with a central vent plug or valve which is necessary for the escape of the gas generated during the process of charging, and also as a means of filling up with water when the level of the electrolyte becomes low by evaporation. It is generally advised to keep the solution at least .5 inch above the tops of the plates. Otherwise there is a danger of injurious chemical action on the portion of the plates exposed to the air.

One of the results of the noticeable tendency to compactness brought about by the application of the storage battery to vehicles is a great reduction in the quantity of electrolyte to plate area, and in this respect the new construction is of no advantage as the chemical action which takes place during the discharge of a battery necessitates the extraction by the paste of the sulphuric acid in solution. If the total quantity of electrolyte is small it follows that a quick drop of the specific gravity of the solution takes place on a heavy demand being made on the battery. It is therefore not desirable to reduce the distance between plates by thinning the separators, and any further development of battery capacity to weight and size is more likely to lie in a chemical direction rather than in constructional or mechanical changes.

Density of Acid Used as Index

The drop of density in the electrolyte during discharge bears a definite relation to the voltage across the terminals, and this fact is made use of in charging batteries as a convenient means of ascertaining the state of the charge. For this purpose a hydrometer, shown in Fig. 1, is used. This measuring device consists of an outer glass tube G provided with a nozzle at its lower end and a rubber bulb at the other. This forms the container; the hydrometer proper, H, is a hollow glass float weighted at the base and graduated along the stem to show the density or specific gravity of any liquid in which it is immersed. To take a reading from a battery being charged a quantity of the elec-

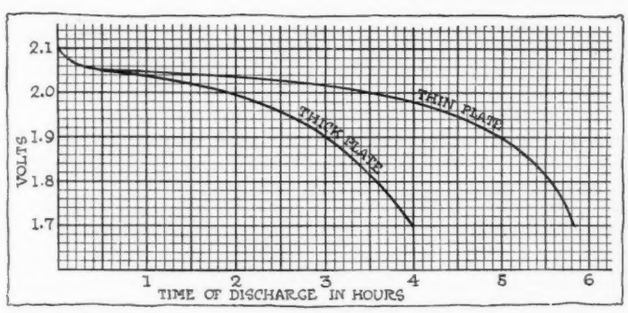


Fig. 6—Comparative curves, showing the gradual drop of voltage in discharging thick and thin plate cells of the same size

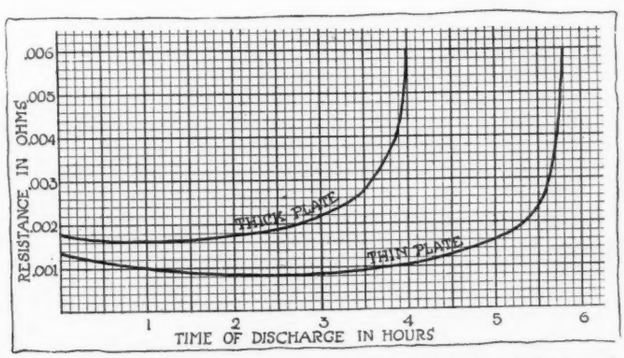


Fig. 7—Curves showing the rise of internal resistance of thick and thin plate cells of the same size during discharge

trolyte is drawn into the container in the manner of a fountain-pen filler and the figure read off the scale at the level of the liquid. When fully charged the specific gravity should be 1.300. This figure falls to about 1.130 on complete discharge.

A good deal of misunderstanding exists as to the bearing of temperature on the operation of storage batteries. The great thing to remember in this connection is to keep the battery well charged. Much unsatisfactory working of batteries in winter weather is caused through neglect of this simple rule. Its importance is well indicated in Fig. 3, which is a curve denoting the various temperatures at which dilute sulphuric acid of all densities up to 1.350 will freeze. The most striking feature of the curve is the remarkably low temperature required to freeze electrolyte at the ordinary charged battery density of 1.300, it being necessary for the mercury to drop to almost 100 degrees below zero Fahrenheit. But with a weakening of the fluid, or a strengthening, for that matter, the freezing point rises so that at a specific gravity of approximately 1.165, as shown in the curve, the electrolyte will freeze at zero. The importance therefore of maintaining batteries in a charged condition during severe weather and consequently the solution at a high density is very evident.

Voltage Drops Throughout Discharge

Two other factors are coincident with this drop of density during discharge. The voltage falls away as the discharge proceeds and the electrical resistance of the cell increases. These are shown graphically in the charts, Figs. 6 and 7. It will be seen that the voltage at the start is 2.1 and that this quickly drops a little and then maintains a voltage in the neighborhood of 2 and gradually falls away to the discharge point, which is common practice is 1.7. To allow a battery to discharge below 1.7 has a deteriorating effect that is prejudicial to the life of the battery.

The two curves plotted in these graphs form an interesting comparison on thick and thin plates. Both are obtained from Philadelphia cells of equal size and weight, the first cell being made up of thick plates and the second of thin plates. As shown by the upper curve the thin plate cell is capable of maintaining its working voltage over a much longer period than the thick plate. This is due solely to the greater area of surface obtainable in a given size cell by using thinner plates and consequently a much greater number to the same space.

Resistance of Electrolyte Varies

One of the chief reasons for voltage drop is the accumulation of sulphate on the plates, which hinders the chemical action, but the increased internal resistance of the electrolyte itself is also largely responsible. A peculiarity of dilute sulphuric acid is that its electrical resistance is low at a certain density or proportion of acid to water, but is raised considerably as soon as the solution is either strengthened or weakened. Its point of lowest resistance corresponds with the density of electrolyte in a charged battery. The variation which takes place during the discharge is shown in Fig. 7, which shows the comparative ohmic resistance throughout the discharge of two cells of equal size and weight. The relation existing between the voltage curves in Fig. 6 and these of the internal resistance is evident. The resistance remains fairly constant for 3 hours in the thick plate and 5 hours in the thin plate cell after which there is a sharp rise. This increase of the internal resistance helps to pull down the voltage across the terminals.

The question of the number of cells composing a battery depends solely on the voltage at which the motor to be driven was designed to work. For the propulsion of electric vehicles, commonly used sizes are 24-, 30-, 42- and 44-cell batteries. Since the voltage of a single cell averages 2 the voltage of a battery is roughly twice the number of cells. **The motors used for electric cranking of gasoline engines are usually worked off 18-, 12- or 6-volt batteries. These voltages have been adopted so as to allow the use of 6-volt lamps, which have become standard practice, on the same battery. In order to do this with the 12- and 18-volt batteries it is necessary to wire up in such a way that the lamp circuits are divided to supply the required voltage to each lamp while the cranking motor receives the full voltage by being connected across the main terminals.**

Batteries that are used for lighting only, or lighting and ignition, are universally of the 3-cell order, supplying current at 6 volts. For lighting purposes the size of the battery depends on the number of hours' service the owner wants per charge.

Battery Points for the Careful Owner

By James S. Skinner
Engineer, Philadelphia Storage Battery Co.

THE following is intended to elaborate a little on four pertinent points concerning the care of lead storage batteries. These points are covered more or less in standard instruction books, but instruction books must necessarily be brief and very seldom give many of the whys and wherefores.

The Electrolyte—Its Components

The electrolyte in a lead storage battery consists of dilute sulphuric acid. At the end of a full charge this is of about 1.300 specific gravity which means about 40 per cent. and 60 per cent. water. At the end of a full discharge the specific gravity may be as low as 1.100 which means about 14 per cent. acid and 86 per cent. water. Evidently acid has either been taken out of the electrolyte during discharge or water has been added. As a matter of fact, both of these things have taken place. In discharging, the active material of both plates has absorbed acid and given off elements which combine to form water and further dilute the electrolyte.

The voltage of a battery depends upon the strength of the acid in contact with the active material. As the discharge proceeds the strength of the acid decreases and the voltage with it. The decrease in voltage proceeds faster than the apparent decrease in acid specific gravity and the voltage will reach 0 before all of the acid in the electrolyte is used up. This is because the lead sulphate which is formed during discharge clogs up the pores of the plates and prevent the fresh inactive acid between the plates from reaching the undischarged active material at the middle of the plates. When the voltage of a cell falls to 0 the actual electrolyte in contact with the undischarged active material has been so depleted of its acid as to have become practically pure water, although the main body of the electrolyte between the plates may still contain a large percentage of acid. This, however, cannot be of any service because of the lead sulphate lying between it and the undischarged active material.

A great advantage in thin-plate batteries lies in the fact that the acid does not have to work its way so far in order to reach the middle of the plates and can, therefore, work much more efficiently and thoroughly. In thin-plate batteries about 50 per cent. more material and 50 per cent. more acid are actually used than in thick-plate batteries, and about 50 per cent. more capacity is thereby obtained in the same space and from the same weight of battery.

During charge the acid which was previously absorbed is given off again into the electrolyte, and at the end of charge the amount should be the same as at the end of the previous charge. This alternate absorption and giving out of acid is characteristic of the discharge and charge of a lead storage battery. Providing acid is not spilled out it is practically never necessary to add fresh acid. A little acid may be lost in the gas which is given off toward the end of each charge, but unless the gassing is very violent this loss need not be compensated for more often than once every 6 months or so and only then after a very long full charge, so as to be sure that all the acid is out of the plates. In itself the gas is not sulphuric acid vapor. It is merely decomposed water and the acid which is lost is simply the very small amount which it carries along mechanically.

Pure Acid Is Necessary

It is important that the acid used be of the highest purity. Any foreign matter in it, especially metals other than lead will tend to set up local action in the battery, which will discharge the plates without the production of any useful current. A battery containing impure acid will not hold its charge. For the same reason it is important that acid of a higher specific gravity than 1.300 should not be placed in a battery since such acid also tends to discharge the plates without the production of any useful current. Furthermore, sulphuric acid stronger than 1.300 specific gravity is likely to hasten the disintegration of the wood separators.

It is not detrimental to the life of the battery to use acid of lower specific gravity than 1.300 at full charge, but somewhat less capacity will be obtained. The decrease in capacity, however, is hardly appreciable until the specific gravity at full charge has fallen to 1.260 or even 1.250.

It is important that the acid level be kept above the plates and separators at all times. If the level falls below the plates the plates will discharge where they are in contact with the air. This discharge will be attended with heating and will produce larger particles of lead sulphate than those produced in a regular discharge and there may be some difficulty in reducing them back to charged active material.

Washing the Battery

"Wash outs" have been one of the bug-a-boos of the electric vehicle battery business. They are dirty affairs at best and are sometimes very unsatisfactory in their results. Their object is of course to remove the sediment which has been deposited from the plates in the bottoms of the jars, so that it may not reach the plate bottoms and cause short circuits. It has frequently happened in an effort toward entire cleanliness, that a hose and a generous stream of water have been used on the plates as well as upon the jars, with the result that practically all of the active material has been washed away and only bare grids left. If a hose is used at all on the plates, it should be with the gentlest stream of water only.

With the advent of thin-plate batteries washing has been very generally done away with. High rib jars are used with sufficient space beneath the plates to hold all the sediment deposited during the life of the battery and with improved methods of charging and improved wood separators the necessity of washouts has been reduced to almost nothing.

Inspection—What It Means

During ordinary charges the only inspection necessary consists of temperature readings, voltage or specific gravity readings or both, and observations as to whether the cells are gassing too hard or not.

The current rate of charging should be adapted to the temperature and gassing observations. Almost any rate may be used as long as the temperature remains below 100 degrees and gassing is not hard, but when the temperature rises to 100 degrees or hard gassing commences, the rate must be reduced. The reduction is preferably made in several steps, cutting each time to a rate below the hard gassing point and continuing the reduction as necessary until the current is about 30 per cent. of the normal discharge rate at which point the charge may be carried to completion. The observations of either voltage and specific gravity will serve to show when the charge is complete.

If overcharge records have been kept, it is well, on ordinary charges to continue the charge until the voltage rises to within 1 or 2 volts of the maximum on the last previous overcharge, or until the specific gravity rises to within 5 or 10 points of the last previous maximum. The observations may be advantageously made upon one or two pilot cells.

Once every week or so it is necessary to more completely inspect the batteries. The height of the electrolyte should be raised to 0.5 inch over the plates by the addition of distilled water and the charge should be continued until the voltage and specific gravity have absolutely stopped rising for 4 hours. This will tend to even up the cells and keep them in good shape. At this time or possibly every other week or once a month it is well to take individual voltage readings on all the cells so that any possible trouble may be quickly located and corrected.

Overhauling—Thin-Plate Type Immune

A thin-plate lead battery will usually need no overhauling until it requires renewal. In replacing the plates the chief source of trouble is the tendency to slight the initial charge. The initial charge is the most important in the life of a battery. If it is slighted the battery will not be ruined, but the chances are that it will not give full capacity for the first half-dozen discharges or more and even then not without full charges between discharges, and the amount of time and current required will far exceed the amount required for a full initial charge.

If the initial charge is made complete, a battery can usually be put to work immediately and will never require anything further than ordinary every-day attention. The only sure way to make the initial charge complete is to continue it at about 30 per cent. of the normal discharge rate until the voltage, and specific gravity have reached their maximum and have remained there for 48 hours. This sounds very simple, but it is one of the hardest rules to enforce. It is very generally the practice to wait only until the battery "looks right" or is "gassing freely" and then to put it into service. Neither of these indications is reliable. The only sure way is to wait for the voltage and specific gravity to remain constant for 48 hours.

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An A B C of the Electric Motor

(*Continued from page 741.*)

Another type of controller called the barrel controller, D, Fig. 5, performs the same functions and is suitable for small or large currents. This type of controller is used on all electric street railways. It consists of a brass barrel B mounted firmly on a spindle S from which, however, it is electrically insulated by a fiber or mica bush, a series of projections on the outside of which curved copper contact pieces form a means of passing the current over to a similar number of copper fingers or brushes F. These latter are provided with springs which force them firmly against the contact pieces.

In the off position the whole of the barrel is isolated electrically and the current therefore not flowing. On turning the barrel a large contact which occupies almost the entire circumference of rotation connects the barrel to the outer circuit. Any further movement then begins to cut in or out the resistances according to the circumferential position of the stepped contacts. The steps of the resistance are connected to the fingers in the same way as on the rheostat.

It is also possible to arrange contacts and fingers to produce the effect of a reversing switch or a change-over, as for instance is required to parallel the pairs of field coils previously series connected. For the purpose of making and breaking the circuit quickly, so as to avoid sparking and consequent injury, a star wheel and spring pawl or other device which makes it only possible to move the handle in jerks is fitted to the spindle.

Storage Battery Operation in Electrics

Vehicles Have Reached High State of Perfection Electrically as Well as Mechanically

Important Points Relative to Care and Attention Required To Obtain Most Efficient Results

By George Taylor
Electrical Engineer, Waverley Co.

IT is rather a general opinion that the storage battery is a mysterious, delicate piece of apparatus requiring an excessive amount of attention and care. This idea harks back to the pioneer days of the electrical vehicle when troubles of every kind were numerous in the operation of the vehicle. Perhaps a large number of the faults were placed to the discredit of the battery, when in reality mechanical features were at fault. However, the present-day electric vehicles, commercial trucks as well as passenger cars, have reached a high state of perfection electrically as well as mechanically, and improvements in storage batteries have kept pace with this progress.

It is not the intention of the writer to enter into a lengthy discussion of the entire subject of battery operation, in all its different phases, but to cover as simply as possible the most important points to be remembered relative to the care, and attention required to obtain the most satisfactory and efficient results in service, drawing conclusions from our past and present practical experience with this subject.

The question of correct charging of lead storage batteries is all-important.

Habitual undercharging means	Abnormally low specific gravity of electrolyte Sulphation of plates	Causing poor mileage and reduced life
Habitual overcharging means	Excessive gasing High temperature Softened plates Injury to wood separators Short circuits	Causing poor mileage and considerably reduced life

A little systematic, intelligent care will obviate all these troubles.

It is absolutely necessary to give all new batteries a "good start." That is, to be assured that they are in first-class condition before being placed in regular service.

Place the battery on charge at the rate for the type and size specified by the makers, first being assured that plates in all cells are covered with electrolyte. If any filling is necessary use distilled water only.

Record Specific Gravity Readings

Select a few cells located in different parts of the battery and record the specific gravity readings of these cells at intervals of from 2 to 3 hours. Continue the charge until the electrolyte registers no increase of Specific Gravity covering a period of two readings. The temperature of cells located in the center of the battery should not be allowed to exceed 100 to 110 degrees Fahrenheit. In the event that this maximum temperature is reached reduce the charging rate, or discontinue charge until the temperature falls to normal, it being understood that the period of time between the Specific Gravity readings must be increased in proportion to a reduction in charging rate.

When the maximum Specific Gravity has been attained record the readings of *each* cell, then allow the charge to continue for approximately 1 hour. If no further rise of the Specific Gravity is noticed in any cell the charge may be considered completed. All cells should register a Specific Gravity of 1.280. Any variation above or below this point should be corrected by equalizing; that is, adding acid to low cells and distilled water to high cells. When adding water it will require .5 hour or more for the water to mix thoroughly with the electrolyte.

In regular service the charging rates recommended by the maker should be observed as closely as possible. Ordinarily, over a certain period of time a predetermined maximum voltage may be taken as an indication of full charge, watching temperature toward the finish of each charge to see that the maximum is not exceeded. At intervals depending on the service, usually 10 days to 2 weeks, overcharging at a low rate after the regular charge should be a regular rule in every garage, following the same procedure outlined above for new batteries. A regular inspection of all cells is necessary for height of electrolyte in the interim between over-charge periods. As a general rule one filling with distilled water will be found sufficient between these over-charge periods in order to keep the electrolyte above the plates.

Require a regular system covering the above on each electric vehicle garaged.

Washing and Cleaning

Washing and cleaning batteries consists of removing the accumulated sediment from bottom of jars, any deposit on plates, and replacing wood separators in the event these are not in condition to be of further use. Washing day for any battery is impossible to predict with any certainty. It is necessary to remove element from a cell in order to determine this. The methods of charging, kind of service, temperature, height of ribs in jar, etc., all tend toward causing this uncertainty. As a general rule it has been found that under ordinary conditions washing will be required from 6 to 8 months for batteries in which jars have one and three-fourths inch ribs. Hard service, or excessive charging will reduce this time, and infrequent using of car will increase the time, even to 1 year or more.

To determine height of sediment in jars it is advisable to examine a cell or two in each battery after 6 months' service. In the event the sediment is well below bottom of plates, no serious amount of deposit on top or sides of plates, and wood separators in good condition, a record should be made of these facts, which record will prove valuable as a means of determining about the time the battery will require to be washed.

Batteries in high-ribbed jars seldom require washing, but an occasional examination of one or two cells is advisable to determine condition of wood separators, and, also, any growth, or deposit, on plates.

Intelligent Handling in Washing

Washing requires intelligent handling of battery, or at least, intelligent supervision. The battery first requires regular charge and the over-charge in order that electrolyte in all cells is up to maximum specific gravity. It is not necessary to equalize the battery before washing. Remove or cut the connectors between adjacent cells, also removing the sealing from the covers, and lift the complete element out of the jar. This procedure also applies when examining one or two cells. It is necessary to replace the element in its jar and cover with electrolyte as soon as possible as the negative plates will tend to oxidize in the air, causing heating of these plates. The element must also be replaced in such a way that the negative group will join the positive group of the adjacent cell. New electrolyte is advised, but the old electrolyte may be used, providing its freedom from impurity and sediment is assured. When using old electrolyte add sufficient new, of same specific gravity, to completely cover plates.

Temporary Connections Necessary

Temporary connections joining the cut connectors should be made and charge started at the low finishing rate. The instructions relative to new batteries should then be followed. It is strongly advised that when this charge is completed a discharge of the battery should be taken at the regular discharge rate for

the type cell in question, in order to determine that all cells are giving same capacity. The charge following this discharge should be a duplicate of the previous charge. Re-burning the cut connectors and re-sealing the cells require the service of men familiar with these operations. Usually, all electric garages include in their service a man capable of handling this work with the proper equipment that will be necessary.

When the wood separators require renewing during the washing process it will be found advisable, when the washing is completed, to use electrolyte of slightly higher specific gravity to fill cells in order to compensate for the water carried into the cells in the wood separators. Wood separators are usually kept wet until used.

The question of renewing plates in the battery depends entirely upon mileage obtainable. Providing a decrease in mileage is known to be due to no inherent defects, but is simply the natural decrease from long life, the battery may be used until mileage is not sufficient for the service required. To renew plates, it is advisable to secure necessary information from the maker covering assembling, filling and subsequent charging.

Edison Differs from Regular Lead Battery

Edison batteries require a somewhat different treatment compared to the regular lead battery. The specific gravity of the electrolyte in the Edison cells cannot be used as an indication of charge, as there is no change in the specific gravity during charge or discharge. So, it is necessary to limit the charge by voltage or time. The charging rates recommended by the maker are higher than those usually advocated by lead battery makers, for comparative size cells, and it is claimed that over-charging is not injurious, providing the temperature is not allowed to exceed the maximum. Low temperature affects the temporary capacity of these batteries to some extent, so it is necessary that before leaving the garage the temperature be well up to normal. Washing is not required, but a periodical renewal of the electrolyte is necessary. The steel containers, or jars, must also be inspected at regular intervals in order to keep all dirt, etc., from accumulating between adjacent cells. Filling with distilled water is required at certain intervals, somewhat more often than with lead batteries, and will have to be determined by experience, as it depends largely upon service and charging methods.

Charging Apparatus Depends on Current

Charging apparatus will necessarily depend upon location and the kind of current possible to obtain. When direct current can be secured, a rheostat in series with each battery is all that is necessary, and these require practically no attention. The volt ammeter included in the car equipment may be used to make the proper adjustments of current, and, also, to determine when the maximum voltage on charge is obtained.

Mercury-arc rectifiers are giving very satisfactory results where alternating current only is obtainable. These, when once correctly set, require only that the capacity of the tube be not exceeded.

Motor-Generator Is Expensive

Motor-generator sets are quite satisfactory, but more expensive than the rectifiers. They require only the attention necessary on all stationary electric motors or generators.

In conclusion a few don'ts may be of value:

First, systematize the care of each battery, which system should include the following:

Keep all cells filled.

Don't allow the temperature to exceed 100-110 degrees.

Don't allow excessive gasing in cells.

Reduce rate of charge if gasing becomes abnormal.

Don't fail to examine cells for sediment.

When in doubt remember that maximum specific gravity cell readings are an unfailing indication of true state of full charge.

And, finally, don't blame the battery until absolutely certain that the fault is not a mechanical one in the car.

Battery Action in Charge and Discharge

Acid Absorbed by Plates During Discharge Is Driven from Plates by Charging Current

Gassing Shows at Any Time Whether or Not Charging Rate Is Too High

By the Exide Battery Depots, Inc.
Philadelphia, Pa.

IN discharging a storage battery the sulphuric acid in the electrolyte combines with the lead in the active material on the plates and forms a compound called lead sulphate. This lead sulphate is formed in the same way that sulphuric acid on the copper wiring or terminals forms copper sulphate, or the acid on the iron work of the car forms iron sulphate. In this connection it is noticeable that a comparatively large mass of copper sulphate or iron sulphate is formed on the metal work of the car when only a small quantity of the metal is eaten away. In the same manner, the sulphuric acid of the electrolyte combines with lead in the plates forming lead sulphate which, on account of its increased volume, fills the pores of the active material.

This sulphate continues to increase in quantity and bulk, thereby filling the pores of the plates. As the pores of the plates become thus filled with the sulphate, the free circulation of acid into the plates is retarded; and, since the acid cannot then get into the plates fast enough to maintain the normal action, the battery becomes less active, as is indicated by a rapid drop in voltage.

Experience teaches that at the normal discharge rate the voltage will begin to drop rapidly very soon after reaching 1.8 per cell. It is therefore advisable to stop the discharge when the voltage has dropped as low as 1.7 per cell, and a battery should not normally be discharged below this point.

During a normal discharge the amount of acid used from the electrolyte in lead-acid batteries will cause the gravity to drop 100 to 150 points. Thus, if the gravity of a fully charged cell is 1.280 it will, at the end of discharge, be between 1.180 and 1.130, depending upon the type of cell. The battery should be put on charge before it is discharged below this point.

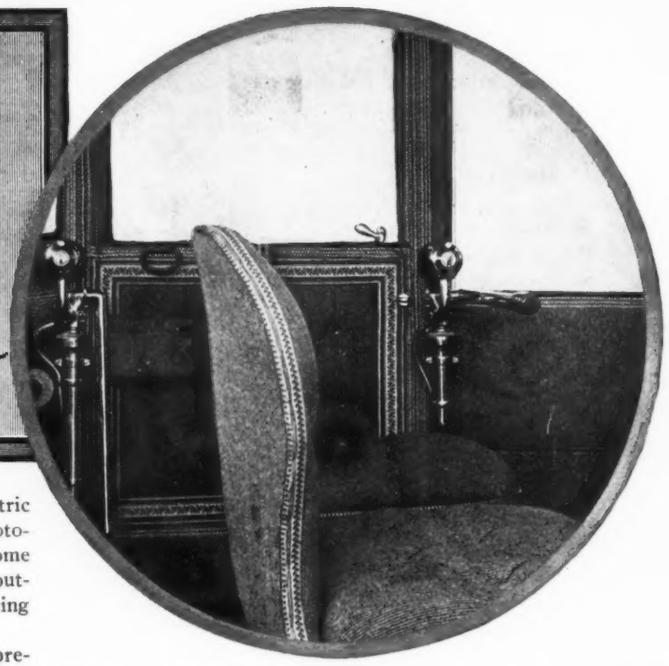
Information on Charging

To charge, cause direct current to pass through the cells in a direction opposite to that of discharge. This current, passing through the cells in the reverse direction, will reverse the action which took place in the cells during discharge. It will be remembered that during discharge the acid of the electrolyte went into and combined with the active material, filling its pores with sulphate and causing the electrolyte to become weaker. Reversing the current through this sulphate in the plates restores the active material to its original condition and returns the acid to the electrolyte. **Thus, during charge, the electrolyte gradually becomes stronger as the sulphate in the plates decreases, until no more sulphate remains and all the acid has been returned to the electrolyte, when it will be of the same strength as before the discharge and the same acid will be ready to be used over again during the next discharge.** Since there is no loss of acid none should ever be added to the electrolyte.

Remember this: THE ACID ABSORBED BY THE

(*Continued on page 779.*)

1914 Electrics



Dual control in model 50 Ohio, showing relative seat arrangement and position of duplicate levers

HEREWITH is published a general review of the electric passenger vehicles for 1914, together with typical photographic reproductions of the leading models. In some instances it has been impossible to give a comprehensive outline of the new models due to the 1914 program not being definitely settled upon.

The adoption of dual or duplex control is one of the predominating features running through a majority of these brief descriptions. Hand in hand with this is greater battery mileage by the use of thinner plates and more plates per cell as well as by using better anti-friction bearings in the chassis, thus reducing the current consumption and conserving it for vehicle mileage.

Greater window space is a general characteristic of all bodies, there being more glass coupled with a general introduction of the sashless type of window. Several makers are fitting double glass fronts in order to give insured clear-vision types.

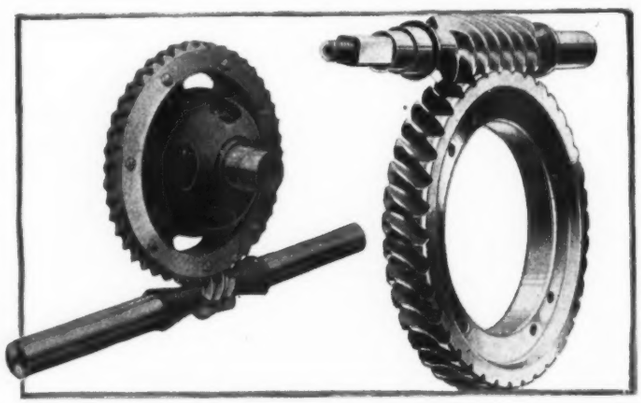
Brakes have been made larger in a great many models and the tendency of placing both sets on the back axle is apparent.

Anderson Electric Car Co.

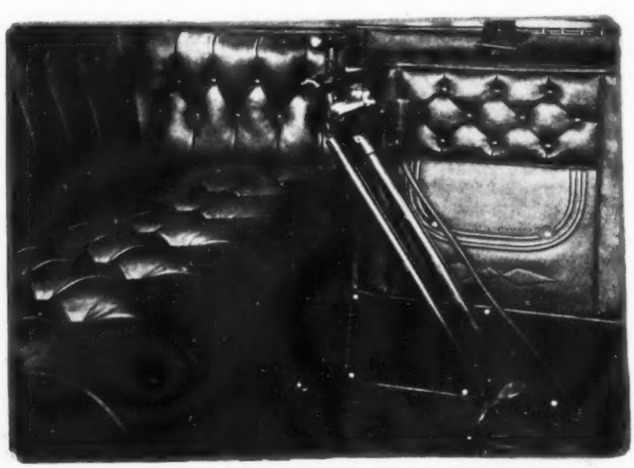
For 1914 there are six models of Detroit passenger electrics which cover the entire field of these vehicles from the palatial five-passenger brougham with its duplex drive to the roadster type, the gamut including Victorias in addition to the various brougham styles. The Detroit for next year is a highly improved vehicle as compared with the 1913, yet is listed at considerably reduced prices over those prevailing during the present year, the price range extending from $2,300 to $3,000.

It can be generally stated that on all models the wheelbase is longer, the additional space gained thereby giving more room in the bodies. Tires are generally larger, an example being that a model fitted with 32 by 4 tires this year carries 34 by 4.5 next year. In addition to larger tires there is an increase in battery capacity all along the line. As heretofore forty cells of lead type are standard in all models but instead of eleven plates per cell the number has been increased to thirteen. This means raising the ampere-hour capacity from 140 to 162. To accomplish this result thinner grids are used, these resulting in a greater mileage per battery charge, and another advantage that may be added is that a higher voltage is maintained with a thin-plate cell which gives more power on hills and aids in acceleration. Batteries for the Detroit cars are assembled at the Anderson plant. For next year the no-wash cell is used, this cell having a deep mud space in the bottom of the cell, this space being ample for all the active material carried in the plates, and making it unnecessary to have the cells washed before the plates are renewed.

A most conspicuous feature of Detroit electrics is that three models for next year will be fitted with worm drive, the Lanchester type of worm mounted beneath the axle being used. The

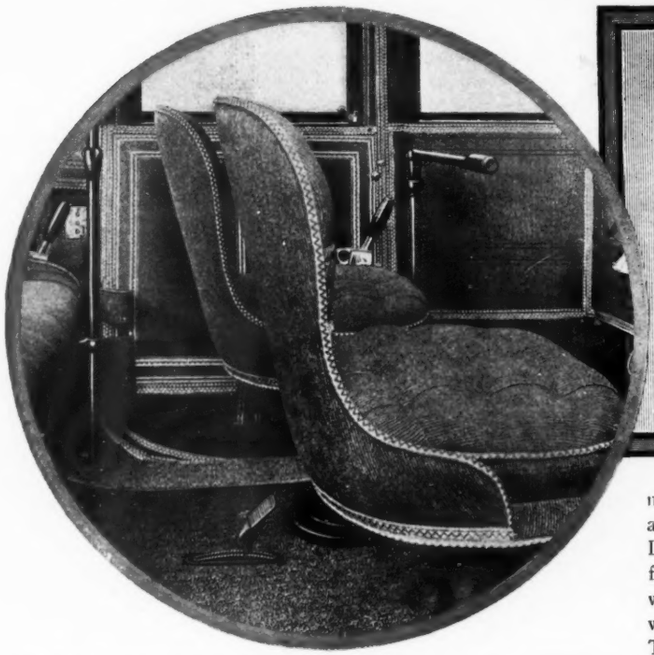


Worm gear on three of Detroit models, showing worm mounted beneath worm wheel and to its right worm drive on R. & L., using straight type worm mounted above the wheel

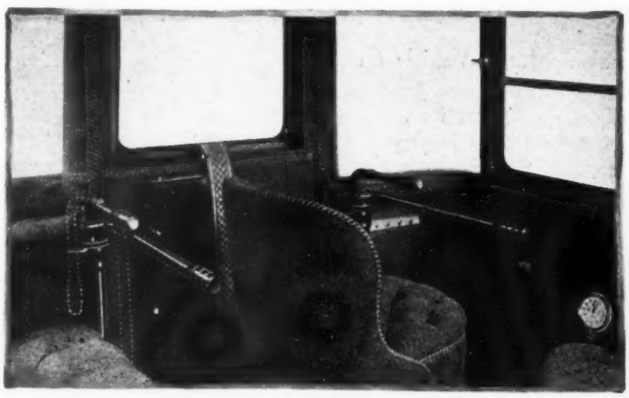


Grinnell dual drive with control parts swung rear of the door when driving from main or back seat. Universal joint connections permit of altering its position

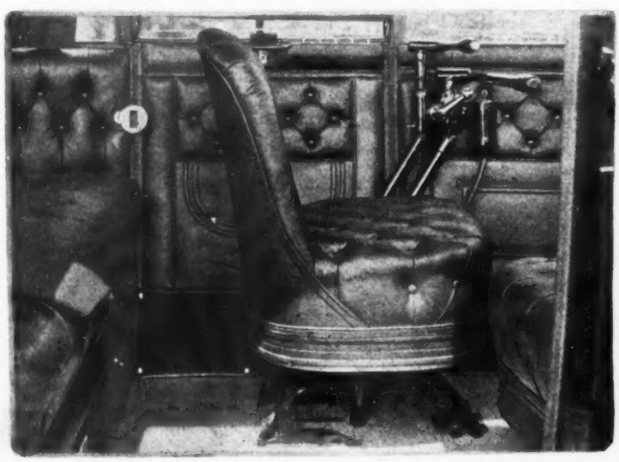
Passenger Vehicles



R. & L. selective dual control drive with interlocking controller handle on front seat. Note position of pedal on the floor under the body of the seats



Dual control in Detroit electrics, showing duplication of steering parts and dotted lines showing folded position of rear seat control parts when not being used



Grinnell dual drive with control parts swung forward of the door used when driving from front seat. The position of the levers for driving from rear seat is shown above

models so fitted are the duplex-drive, five-passenger brougham, a single-drive four-passenger brougham, and the roadster. The Lanchester worm is of the hour-glass type, the teeth being so formed as to partially embrace the circumference of the worm wheel which is fitted to the differential, the teeth of this worm wheel being also concaved to adapt themselves to the worm. Three teeth of the worm are always meshing simultaneously and share the driving load. Mounting the worm beneath the worm wheel permits of its constantly running in a bath of oil.

On the other three Detroit models, namely, Victoria, four-passenger brougham, and five-passenger brougham, bevel driven axles are employed.

Not to be overlooked in Detroit electrics for next year is the duplex drive used on one model officially known as Model 48. In this model all passengers face forward, the two front passengers occupying individual arm-chair type seats. The duplex drive consists in two steering tillers, two controller handles, in short two complete driving units, one for the front seat passenger, the other for the rear. When the front seat drive is being used the rear seat control parts fold against the wall, and vice versa.

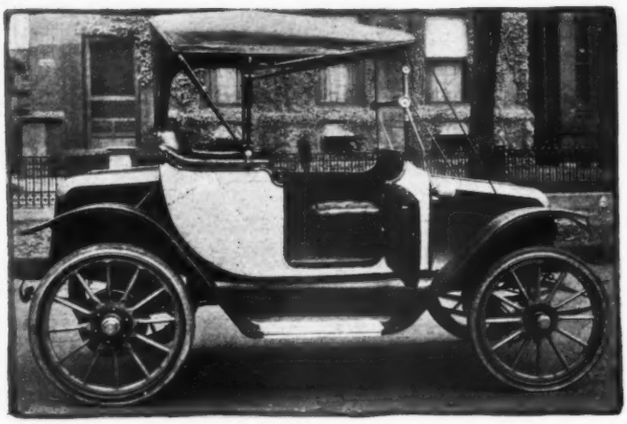
On several Detroit models the Hanlon patented rain-vision front window is regular equipment. This window consists of two glass panes for the upper half of the glass front. Both are hinged at the top, and one is outside of the other. Both can be pushed forward to any angle, or the inner one can be left closed or vertical. The object of the outer pane is that it forms a protection against window rain while the inner pane may be left vertically. In winter weather both of the panes may be brought all the way down in which case there is an air chamber between them which prevents either frosting.

Further improvements in Detroit electrics show a general increase of brake capacity, the brake drums of the rear hubs being increased generally.

Bodies in all cars have been improved throughout. Internally they are wider and longer. Whipcord is most popular in interior finish, although there is steady demand for leather. When either is used plain walls and ceiling in contrast with the tufting of previous years is used. On nearly all models the crown form of rear fender is a feature. Equipment forms an important feature throughout and include speedometer, clock, Weston volt-ammeter, and the latest styles in sunburst lights, vases, etc.

Argo Electric Vehicle Co.

Argo electrics for 1914 are manufactured in two chassis sizes, one with 108.5-inch wheelbase on which are roadster and brougham bodies, and the other with 110-inch wheelbase taking a limousine body. While the Argo chassis for 1914 is practically the same as that of this year, there are some minor improvements which work for greater battery economy, one of these being the substitution of Hess-Bright double-row bearings on the



Woods model 13-30 runabout with auxiliary front seat. Price $2,500

outside and inside of all wheels which take the place of the previous single-row bearings at these points. Provisions have been added for the better protection of these bearings from dirt.

Body lines have been considerably improved and details more completely worked out than heretofore. In this connection the adoption of sashless glass for the windows is general in all models.

The equipment has been changed by the addition of such accessories as clock, hat-carrier, parcel-carrier, and two reflex mirrors. The company still continues to make every window in the body capable of being opened if necessary.

Looking at the Argo chassis it is noted that the battery equipment remains the same as at present, namely, forty cells of eleven-plate Exide, which will give an increased mileage radius over that of this year due to bearing improvements and other refinements in the running parts of the chassis. The motor remains practically the same excepting in that its torque characteristics have been modified to give more rapid acceleration and a slightly higher speed for hill-climbing work. Drive from the motor to the rear axle remains unchanged.

The four-passenger roadster is listed at $2,500, the four-passenger brougham at $2,800 and the five-passenger limousine at $3,250.

S. R. Bailey & Co.

The Bailey Model F roadster and the Victoria-Phaeton will be continued for 1914 with some changes, and a new model has been added known as a four-passenger Model F roadster, which has practically the same specifications as the present two-passenger roadster, excepting that it carries as standard battery equipment sixty cells of the Edison A-6 type. The car also has a longer wheelbase, 132 inches, as compared with 112 inches in the two-passenger car. Its standard maximum speed is 25 miles per hour on the level but by using a slightly different motor a higher speed than formerly obtained is now possible on the hills. With this equipment an average speed of 20 miles per hour and a battery radius of 60 to 80 miles is claimed. The Bailey company uses special pneumatic tires on all its models, and on this new one 34 by 4 U. S. types are used.

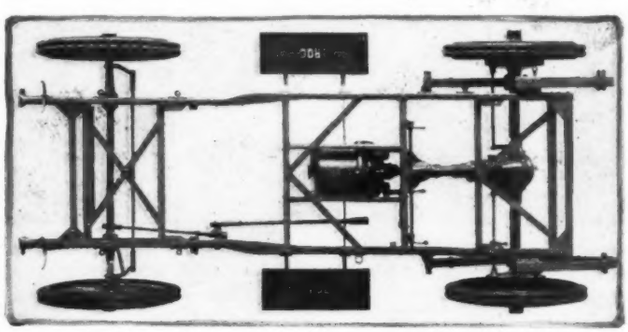
The Model F roadster of the present year, while continuing the 112-inch wheelbase has the body lengthened 6 inches and the forward part of the chassis narrowed 7 inches, making it now possible to turn in a street 40 feet 6 inches wide. The seats are slightly wider and a one-piece hood and cowl designed with the object of reducing wind pressure to a minimum has been used. As at present it carries sixty cells of A-5 Edison battery, and continues the standard Bailey drive used on all models which is by Morse silent chain from the motor to the countershaft and thence to the rear wheels by side chains. The price remains at $2,900.

In the Victoria-Phaeton but one or two minor changes have been made, one being the use of screw-and-half-nut type steering gear, which is also being used on both roadster types. This Victoria carries fifty-four cells of Edison A-4 battery, and is geared to 20 miles per hour. It uses 34 by 3.5 Goodrich-Palmer web tires. As on all of the other models two sets of brakes are fitted, one contracting bands on 12-inch rear wheel drums, and the other contracting bands on the drum on the motorshaft. In the roadsters the second set of brakes are 14-inch drums on the countershaft.

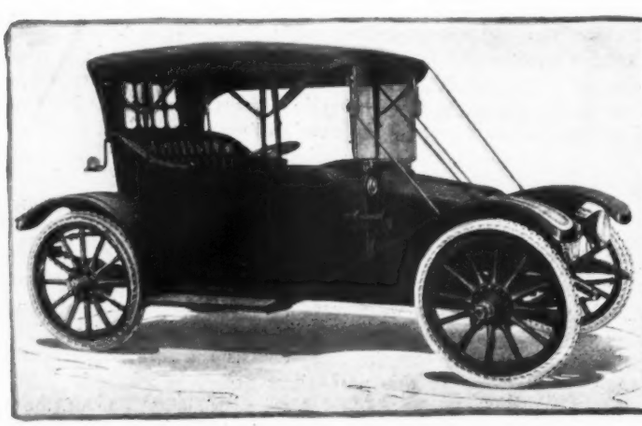
In all the Bailey models batteries may be inspected and removed by raising the front hood and the rear deck. The Bailey patent spring suspension remains unaltered, and incorporates one cross spring extending almost the entire length of the front axle.

Baker Motor Vehicle Co.

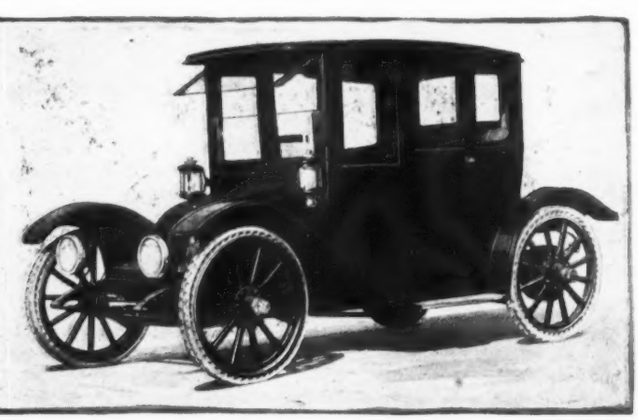
The Baker company a long time ago discontinued the annual model conception, its policy in place being to incorporate improvements into its vehicles at any convenient time whether



Broc chassis, showing motor mounted amidship, bottle neck frame construction and drive from motor to rear axle



Argo model B roadster, four passengers, $2,500



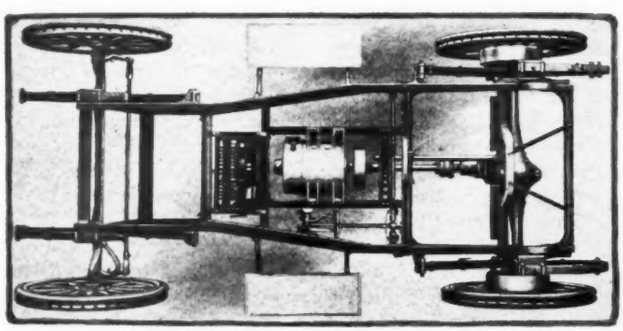
Argo model A brougham, five passengers, $2,800

in the mid season or at the end of the season. In accordance with this policy the bodies of its present passenger line are refined by the elimination of sashes from the window glass and a slight softening of the roof line. The company feels that simplicity is the one aim in electric vehicles and questions the advisability of duplicate steering and control mechanisms because of this, although listing one such model. The upholstering is more elaborate than heretofore, the use of imported materials and designs to suit the whims of the individual buyers being a feature of this part of the Baker policy.

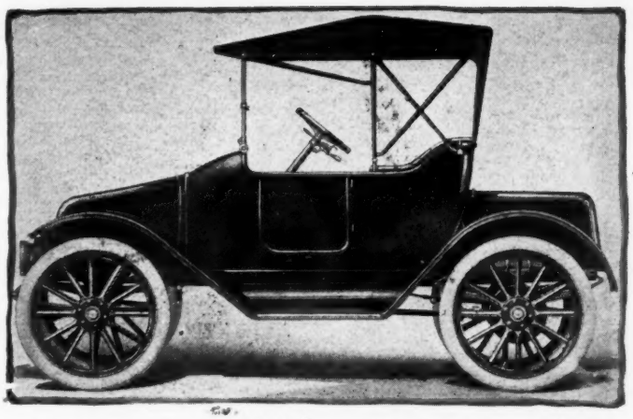
Present policies concerning battery equipment and support are continued, the equipment differing materially according to the type of car, the runabout which requires great mileage representing one extreme, and the large brougham calling for forty-cell equipment another. Thin-plate cells are used in the runabout, and Hycap-Exide in all other types. Batteries are placed under hoods which are hinged and readily opened, and the trays arranged for easy removal. When the hoods are raised all cells are open for inspection.

Some years ago the Baker company adopted a high-speed motor and continues to use it in practically the same form. In its bevel-driven car the double reduction between the motor and rear axle is continued, this reduction being 12 to 1. On the new double-drive brougham the Lanchester-Daimler worm is used for reduction at the rear axle, the reduction ratio being 11 to 1.

The roadster, one of the new models, which is capable of 30 miles per hour, is well suited for general use. It has the battery disposed fore and aft in the usual form under curved hoods, and the lines of these, coupled with the use of flanged steel fenders give the car a striking similarity to a gasoline type. Mechanically there is no alteration in this runabout chassis, which is the same as used on the coupé model this year. The side members of the pressed steel frame are straight from front to rear and the motor is supported midway on a three-point suspension prin-



Chassis Chicago electric, showing tapered bottle neck frame, also compact motor and controller position



Baker shaft-drive runabout with pneumatic tires, wheel steering, 88-inch wheelbase. Price $2,300

ciple giving a straight-line shaft drive to the axle, the shaft having two universal joints. There is, however, one speed reduction between the motor and the forward end of this shaft through silent chain. The ratio from the motor to the rear wheels is 12 to 1.

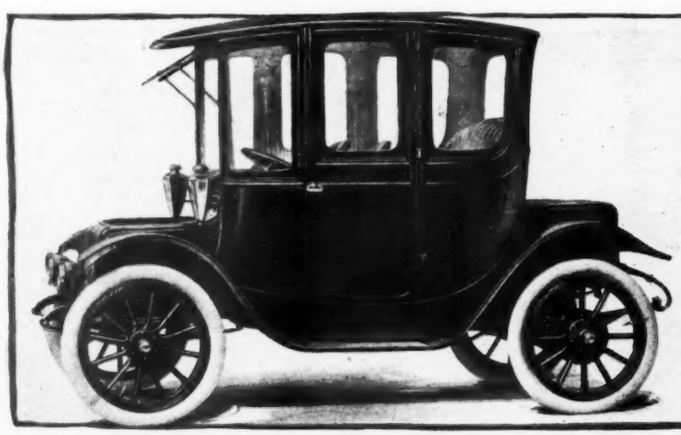
The controller, operated by a short lever on the steering column beneath the steering wheel, is of the barrel type and located under the foot boards in compact relationship between the battery and motor. It provides six forward speeds. G. E. motors are used, these motors being severely tested before fitted in the chassis.

Double internal expanding brakes are fitted to the rear wheels, the frictional surfaces consisting of leather pads perforated and lubricated with graphite. This runabout has an 88-inch wheelbase and carries 32 by 4 pneumatics front and rear. Its equipment includes mohair top, side curtains, folding windshield, electrical instruments, odometer, tools, etc.

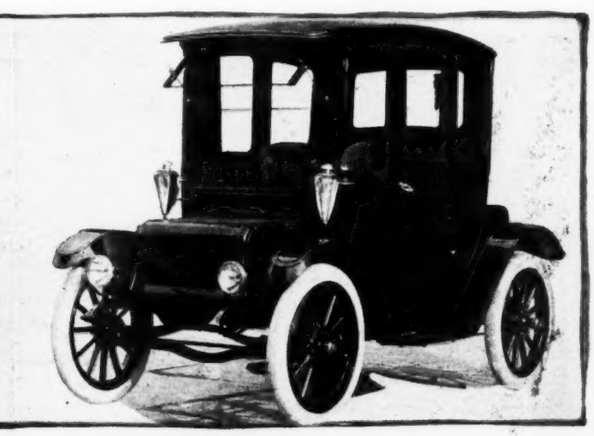
Borland-Grannis Co.

Three models are listed by the Borland-Grannis Co. The cheapest is the open roadster with a speed range of 5 to 25 miles per hour, and a range of battery per charge of 75 to 90. This model lists at $2,550 and carries forty-two cells, eleven plates Exide battery. An optional tire equipment is given, the sizes being 34 by 4 inches all around. This vehicle uses the standard 96-inch wheelbase.

The other two models, namely, five-passenger coupés in one model, of which all passengers face forward, lists at $2,900, and have practically the same equipment throughout excepting in battery. The difference here lies in the fact that in the all-face-forward model, forty cells, eleven plates per cell, are used, and



Broc model 32-B new four-passenger brougham, 96-inch wheelbase, 34 by 4 pneumatic tires, or 36 by 4 cushion. Price $3,000



Broc model 29-B new four-passenger style, 96-inch wheelbase, 34 by 4 pneumatic, or 36 by 4 cushion tires. Price $2,950

Chicago electric, model 142, five passengers, 104-inch wheelbase, 36 by 4 tires. Price $3,300

Chicago model 143, new four-passenger type, 96-inch wheelbase, 36 by 4 tires. Price $3,000

in the other, forty cells of nine plates per cell. The all-face-forward type has a mileage radius of 70, and speeds of 5 to 22 miles per hour.

In all models the Borland chassis characteristics are alike and are settled around a channel steel frame construction supported on semi-elliptics in front and elliptics in rear. From the motor there is a double reduction drive to the rear axle, the first reduction being by silent chain to the forward end of the propeller shaft and the second by bevel gear in the rear axle.

Broc Electric Vehicle Co.

The Broc company has a multi-model program for next season, not fewer than eight being listed, four of which are 1913 styles carried over with some improvements and the price reduced from $100 to $150 each. The other four are new 1914 models and incorporate the latest drive features. For example one Model 33 is a five-passenger rear-drive brougham having two front revolving pedestal seats; another model 34 is a five-passenger front-drive brougham with two revolving pedestal seats; a third new model is a five-passenger, front-drive brougham with two revolving pedestal seats and wheel steering; and the last and most expensive of the new models is the double-drive five-passenger brougham listing at $3,200. The other new models list at $3,100, and $3,150.

Broc electrics for next year incorporate two important improvements. One is a magnetic breaker fitted to prevent damage on account of unskillful driving, due to holding the controller lever in a position where the contacts of the controller would be between speeds, where there would be a possibility of arcing and consequent damage to the controller. The magnetic breaker prevents such arcing and is considered fool-proof.

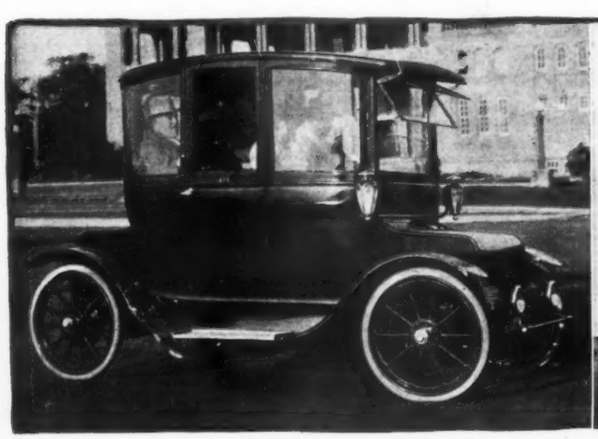
The simplicity and safety of the double control operating and steering mechanism of Model 36 is a second improvement in the company's line. In this double control there are separate parts for front and rear seats. The steering handles and the controller levers project from ball caps on the tops of their respective posts and both levers swing to a vertical position to permit of easy access and the control parts swing down out of way when not in use, and can be locked in this position. Although the company anticipates considerable demand for this double-drive car, which lists at $3,200, it does not look upon it supplanting either the front-drive or rear-drive car, the addition of the extra drive meaning of course additional cost. The idle brake pedal, instead of projecting from the car floor, can be quickly disengaged and laid flush with the floor and so out of the way.

In all of the four new models the width of the bodies have been increased 5 inches and the length 4.5 these extra dimensions being particularly necessary in the double-drive and front-drive types, and gives ample room for three passengers on the rear seat as well as plenty of knee room for the front seat passengers. The driver's seat is large and roomy, and of the revolving type.

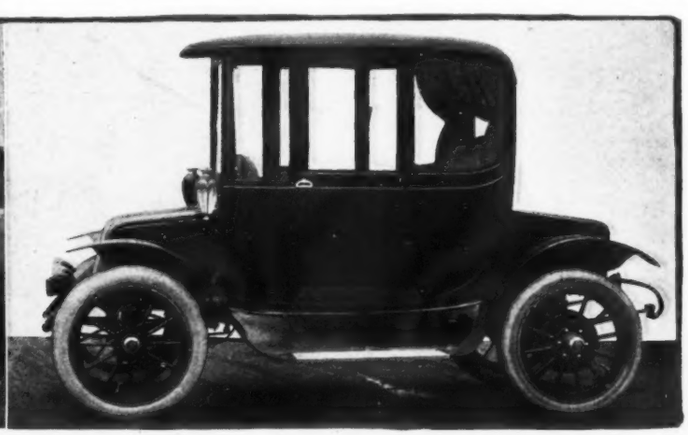
The battery equipment through all models is forty cells of eleven-plate Hycap-Exides, with which the company claims to be successful, obtaining a mileage of 80 to 100 with ordinary city running conditions, the Broc policy as far as battery is concerned, being to keep the weight as low as possible and raise the efficiency in other ways.

High-speed motors are fitted the speed ranging at 1,450 revolutions per minute. From the motor mounted amidship drive is through short shaft with a single universal to a double-gear reduction in the rear axle, spur and bevel gears being used in this reduction. The propeller shaft is enclosed in a torque tube, which at its forward end is journaled to the motor case.

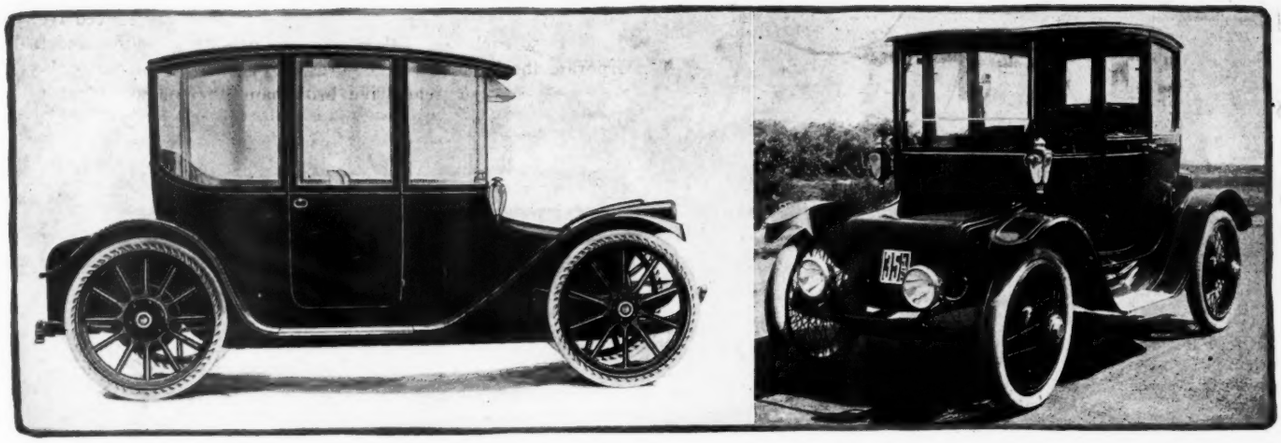
Tire equipment is standardized on all models, being either 34



Grinnell 1914 model with dual drive and double glass rain vision front



New Ohio model 40



New model LB Century, showing front of frame underslung and rear overslung fitted with Century duplex drive

Type 50 Borland coupé with special Rudge-Whitworth wheels furnished at additional price of $2,900

by 4 inch pneumatics or 36 by 4 inch regular cushion types.

A conventional type of chassis construction is used throughout and is built up around a pressed steel frame construction supported on semi-elliptic and three-quarter elliptic springs front and rear, the company believing that good spring suspension is the only method of protecting the battery against vibration. Two sets of mechanical brakes are fitted, one an expanding type on the rear wheels operated by pedal, and the other a contracting brake on the drive shaft operated by the controller handle. Wheelbases are 96 inches on all of the 1913 types carried over and 98 inches on the newer types. I-beam front axles are used and floating type rear.

Buffalo Electric Vehicle Co.

The Buffalo electric for next year is made in three models all of which are mounted on the same chassis which has undergone few if any alterations. This chassis is characterized by direct drive from the motor to the rear axle employing but a single gear reduction, the motor and rear axle being a unit to all intents and purposes in that the tube enclosing the drive shaft bolts direct to the motor housing at the front and to the axle housing at the rear. The motor is suspended by a three-point system through trunnions from a tubular cross-member of the frame, this cross-member being located practically in line with the front end of the rear springs, an arrangement which permits of the necessary radial movement due to spring action.

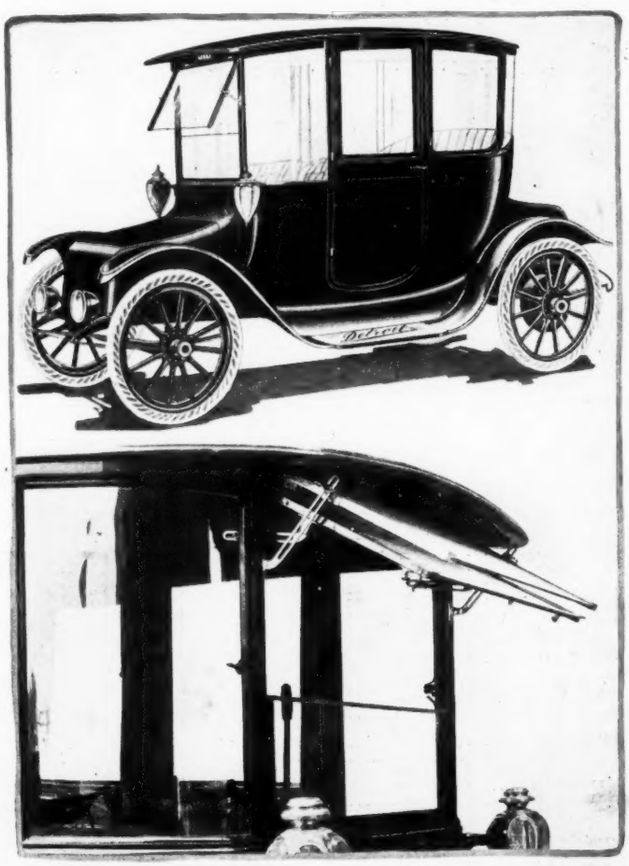
The standard battery equipment is forty-two cells Philadelphia battery, fifteen plates to the cell, which gives a mileage of 75 per charge. The controller is a barrel type and in conjunction with it is a pedal-operated switch which, in addition to applying the service brake, cuts out the current. Both service and emergency brakes operate direct on rear wheel drums, one set contracting types the other set expanding. The control of the Buffalo electric has been simplified as much as possible and with it starting and stopping are simple operations. To start, the service brake is depressed, the controller handle is then set for a convenient forward speed, and by slowly raising the foot and releasing the pedal the car moves forward. The first action of the pedal releases the brake and the further action brings the current into use through a starting resistance. Still further releasing the pedal gradually cuts out the steps of the resistance until the car is running on the full current as determined by the controller.

In stopping the control lever can be entirely forgotten, it being only necessary to apply the brake and having brought the car to a standstill in this way the control lever is brought to neutral cutting off all current.

Three body types are fitted on this chassis, the first a four-passenger coupé with the two seats facing each other, the second a two-passenger roadster, and the third a brougham. The brougham resembles the coupé in external lines, but has a larger seating compartment to allow for the seating arrangements in which the four passengers face forward. The list prices are: roadster $2,600, coupé $2,900, and brougham $3,000.

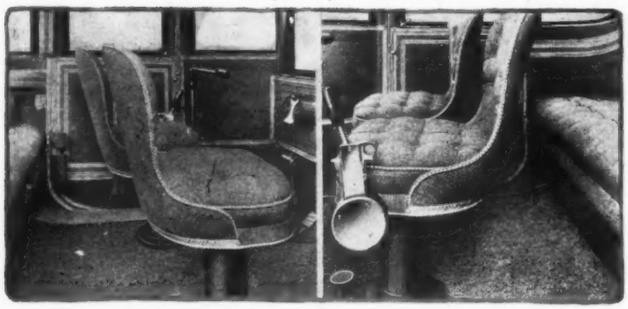
Century Electric Car Co.

The Century name is carried by a brand new model for the coming year in addition to the Model SB brougham of underslung construction. The new model, known as type LB, is representative of the latest in the electric builder's art and includes



Detroit 1914 model, showing crowned rear fender and window space occupying almost entire body

Several of the Detroit electrics are fitted with a patented Hanlon rain shield which consists of two separate glasses forming the upper half of the front window; one can be closed and the other left open to serve as a rain shield



At the left are Rauch & Lang double revolving seats in electrics for forward drive only. At right are R. & L. controlling device. When chair is turned at any position except straight ahead, driving power is automatically cut off

among other features the duplex drive, underslung frame at the front end and overhung at the rear, a new type of controller, clear-vision front, and a general stream line appearance. The price of this new model is set at $3,250, while the other lists at $2,650.

It is a tendency among electric vehicle makers to increase the wheelbase somewhat in order to get the advantage of easier riding, since the longer wheelbase eliminates the jerky motion common to short wheelbase cars. To this end the new Century has a wheelbase of 104 inches. The length within the new brougham is 72 inches from glass to glass.

The streamline bodies of both cars have the hoods, which slope to the front, rounded out into the bodies with unbroken lines. Sides and top are made of hammered aluminum built around a hardwood frame. The top aluminum sheet is a single piece.

The clear vision idea is carried out completely. Curved front panels round the corners, coming from the door casing and ending at the front panel casing. Across the back there is a large pane of glass giving an unobstructed view through the rear. Windows are of the adjustable drop, sashless type. The plain glass panes rest in felt grooves, and anti-rattling clamps are fitted to the frames. A feature of the aluminum running board construction is the inlaying of small cocoa mats below the doors to prevent the tracking of mud into the car.

The interior dimensions of the new Model LB reflect a tendency toward greater comfort for the passengers in the way of more roomy and wider seats, and greater leg room. The rear seat width is 50 inches; depth 20 inches; cushion 8 inches thick. The width between the doors is 58 inches and between the forward and rear seats 10 inches is provided. The door width is 26 inches. The front seats are also very comfortable having a depth of 19 inches and width of 18 inches. Plenty of space for miladi's hat is given by the 42-inch distance from the top of the rear seat to the roof.

The controller on the Model LB is in duplicate form and within easy reach of the rear seat or the forward seat when the latter is in driving position. The controller is of magnetic type and appears in entirely new form. A short lever somewhat resembling the spark or throttle lever on the steering wheel of the gasoline car takes care of the six speeds forward or reverse. Thus horizontal handles of any type are done away with, the lever playing over a quadrant on top of the controller box.

A feature of the control is the fact that it may be operated either by hand or foot. For foot operation, by a gradual forward movement of the pedal, the car speed is diminished. Continued downward movement applies a cutout, then a dynamic brake and finally a mechanical brake acting on the rear wheel drums to bring the car to a full stop. By allowing the brake pedal to come back to its normal position, the driving speed is again continued. The other pedal also operates a cutout and is the emergency

SPECIFICATIONS, PRICES, ETC., OF ELECTRIC PASSENGER CARS

Name and Model	Body Style	Price	Seats	Wheel-base	TIRES		BATTERY		Miles per Charge at 20 M.P.H.	Motor	Forward Drive	Speeds	Steer
					Kind	Size	Make and No. Cells	Amp-Hr Capac.					
Argo, B	Roadster	$2,500	4	108½	Opt.	36x4*	Exide, 40	138	100	West'house	Bevel**	5	Wheel
Argo, A	Brougham	2,800	4	108½	Opt.	36x4*	Exide, 40	138	100	West'h'se	Bevel**	5	Wheel
Argo, C	Limousine	3,100	5	110	Opt.	36x4*	Exide, 40	138	80	West'h'se	Bevel**	5	Wheel
Bailey													
Bailey, F	Roadster	2,900	2	112	Pneu.	33x4	Edison, 60	187½	75–100	Gen.Elec.	Chain	6	Wheel
Bailey	Phaeton	2,600	3	82	Pneu.	32x3½	Edison, 54	150	60–90	Gen.Elec.	Chain	4	Wheel
Baker, WA or WB	Open type	2,300	2	88	Pneu.	32x4	Exide, 34	153	75–100	Gen.Elec.	Chain	6	Opt.
Baker, VAE	Coupe	2,800	4	88	Opt.	32x4	Exide, 34	153	75–100	Gen.Elec.	Chain	6	Opt.
Baker, ZF	Brougham	3,100	5	92	Opt.	34x4½	Exide, 42	135	75–100	Gen.Elec.	Chain	6	Opt.
Borland, 52	Roadster	2,550	2	96	Opt.	34x4	Exide, 42	112	75–90	Gen.Elec.	Bevel	6	Wheel
Borland, 50	Coupe	2,900	3	96	Opt.	34x4	Exide, 40	112	80–100	Gen.Elec.	Bevel	6	Lever
Borland, 58	Coupe	2,900	5	96	Opt.	34x4	Exide, 40	112	70	Gen.Elec	Bevel	6	Lever
Broc, 28	Brougham	2,900	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Lever
Broc, 29	Brougham	2,950	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Lever
Broc, 31	Brougham	2,950	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Lever
Broc, 32	Brougham	3,000	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Wheel
Broc, 33	Brougham	3,100	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Lever
Broc, 34	Brougham	3,100	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Lever
Broc, 35	Brougham	3,150	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Wheel
Broc, 36	Brougham	3,200	5	96	Opt.	36x4	Exide, 40	135	75–95	West'h'se	Bevel***	5	Lever
Buffalo, 29	Roadster	2,600	2	100	Opt.	34x4½*	Phila., 42	140	66	Diehl	Bevel	5	Opt.
Buffalo, 30	Coupe	2,900	5	100	Opt.	34x4½*	Phila., 42	140	60	Diehl	Bevel	5	Opt.
Buffalo, 30B	Coupe	3,000	5	100	Opt.	34x4½*	Phila., 42	140	58	Diehl	Bevel	5	Opt.
Century, SB	Closed	2,850	4	96	Opt.	36x4	Opt. 30	165	75	West'h'se	Bevel	6	Lever
Century, LB	Closed	3,250	5	104	Opt.	36x4½	Opt., 42	140	90	Gen.Elec.	Bevel*a*	4	Lever
Chicago, 131	Coupe	3,000	5	96	Cush.	36x4	Exide, 40	140	75–100	West'h'se	Bevel	5	Lever
Chicago, 141	Coupe	3,000	5	96	Cush.	36x4	Exide, 40	140	75–100	West'h'se	Bevel	5	Lever
Chicago, 142	Limousine	3,300	5	104	Cush.	36x4	Exide, 40	140	75–100	West'h'se	Bevel	5	Lever
Detroit, 43	Brougham	2,550	4	94	Opt.	34x4*	Lead, 40	....	50–85	Own	Bevel	5	Lever
Detroit, 45	Brougham	2,800	5	98	Opt.	34x4*	Lead, 40	....	....	Own	Bevel	5	Lever
Detroit, 46	Roadster	2,850	4	100	Opt.	34x4½*	Lead, 40	....	....	Own	Worm	5	Lever
Detroit, 47	Brougham	2,850	4	100	Opt.	34x4½*	Lead, 40	....	50–85	Own	Worm	5	Lever
Detroit, 48	Brougham	3,000	5	100	Opt.	34x4½*	Lead, 40	....	50–85	Own	Worm	5	Lever
Fritchle	Colonial Brougham (patented)	3,600	5	....	Pneu. or Motz cush.	34x4	32	....	70 to 90	4 h.p. Fritchle recharging	Worm direct shaft	....	Horizontal lever

*Pneumatic size given. **With herringbone. ***With spur. *a*With worm.

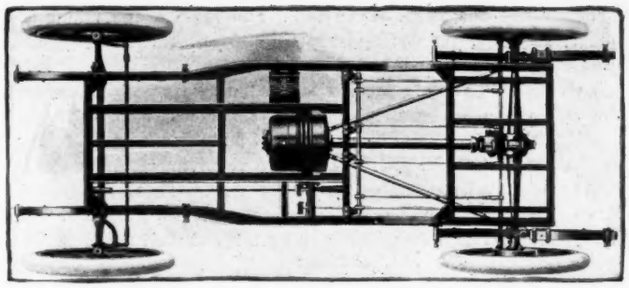
brake externally contracting on the brake drums. To reverse the car, a small button in the top of the controller is pulled up until it catches. Then the speed lever operates the same as ever and sends the car backwards.

The steering is by horizontal lever, and like the controller, is in duplicate for either forward or rear drive. For the front driving, the front seat, which is pivoted, is swung around in position and a latch holds it rigidly—a necessity for driving. There are also two sets of pedals for use in either driving position. When driving from the rear, the front seat may be turned round out of the way.

The new model LB Century carries more battery than the model SB. Forty-two cells of Exide or Willard battery are carried in forward and rear compartments, whereas the model SB has thirty cells. These are of the non-wash jar type in which the plates are carried on ribs in the bottom of the jars. With car speeds ranging from 4 to 22 miles an hour, the battery on model LB has a capacity of 80 to 110 miles an hour. At average running speeds on the level, it is probable that the car is good for about 80 miles on a charge.

The motor used is of General Electric make of the slow-speed type. It is a 4-pole, series wound type and said to be good for 500 per cent. overload. This motor is mounted about amidships and on three points. The drive back to the axle is through a direct shaft with no reduction except in the rear axle. The drive is taken through the springs. All wiring is carried in conduits as protection against water or acids.

The pressed steel frame construction of the new Century is of unusual design in that while the forward end retains the underslung construction with the spring passing above the axle, the rear "kicks-up" over the axle. The rear suspension is by a platform construction, the side springs passing under the axle. The springs are of silico-manganese steel and have a total length of 216.75 inches, made up as follows: Front springs, 43 inches long. Rear side springs, 45 5-8 inches long. Rear cross spring, 39.5 inches long. These all are 1.75 inches wide.



Standard chassis, showing bottle neck frame construction, central location of motor with angling brace rods to the rear axle, also inclosed shaft-drive with double reduction gears within the rear axle housing

The axles are Timken; I-beam front and floating rear. The brakes are conventional internal expanding service and external contracting emergency types, the drums being 15 inches in diameter and 2.5 inches wide.

A special feature of the running gear is the provision against continual oiling of the various bearing surfaces. All these are completely inclosed and packed with grease. No spring grease cups are fitted, the spring bolts working in special graphited bushings. Thus it is stated that after the car leaves the factory no oiling is required except a few bearings and the differential at intervals of about 6 months.

The standard tire equipment of the model LB is Motz 36 by 4 1-2 inches.

The model SB differs from the brougham of this season only in a few minor refinements. Its general appearance and con-

SPECIFICATIONS, PRICES, ETC., OF ELECTRIC PASSENGER CARS

Name and Model	Body Style	Price	Seats	Wheel-base	TIRES		BATTERY		Miles per Charge at 20 M.P.H.	Motor	Drive	Forward Speeds	Steer
					Kind	Size	Make and No. Cells	Amp-Hr Capac.					
Fritchle	Colonial Extension Coupe	....	5	96	Pneu. or Motz cush.	34x4	32	....	80 to 100	4 h.p. Fritchle recharging	Worm direct shaft	5	Horizontal lever
Fritchle	Colonial Coupe	$3,000	4	....	Pneu. or Motz cush.	34x4	32	....	80 to 100	4 h.p. Fritchle recharging	Worm direct drive	5	Horizontal lever
Fritchle	Torpedo Roadster (design patented)	2,400	3	....	Pneu. or Motz cush.	34x3.5	32	....	100	3 h.p. Fritchle recharging	Worm gear direct shaft	5	Horizontal lever
Fritchle	Touring Car Torpedo	2,500	5	....	Pneu. or Motz cush.	34x4	16 rear 16 front	....	70 to 100	.....	Worm direct shaft	5	Horizontal lever
Grinnell, K	Brougham...	2,950	4	94	Opt...	34x4*	U.S.L., 30..	175	65	West'h'se...	Bevel.....	5	Lever
Grinnell, R	Brougham...	3,400	5	105	Opt...	34x4½*	U.S.L., 40..	175	80	Own.....	Bevel.....	5	Lever
Grinnell, S	Brougham....	....	5	100	Opt...	34x4½*	U.S.L., 40..	158	75	Own.....	Bevel.....	5	Lever
Ohio, O	Brougham...	2,900	5	98½	Opt..	34x4½*	Exide, 40..	160	75–125	Gen.Elec...	Bevel.....	5	Lever
Ohio, M	Brougham...	3,200	5	98½	Opt...	34x4½*	Exide, 40..	160	75–125	Gen.Elec...	Bevel.....	5	Lever
Ohio, Y	Brougham...	3,500	5	98½	Opt...	34x4½*	Exide, 40..	160	75–125	Gen.Elec...	Bevel.....	5	Lever
Rauch & Lang, R	Roadster....	2,600	3	92	Opt...	32x4*	Opt., 42....	153	50–100	Hertner....	Worm.....	6	Lever
Rauch & Lang, CR	Roadster....	2,800	3	92	Opt...	32x4*	Opt., 42....	153	50–100	Hertner....	Worm.....	6	Lever
Rauch & Lang, DB	Demi-Broug..	2,800	4	86	Opt...	32x4*	Exide,42..	....	50–100	Hertner....	Worm.....	6	Lever
Rauch & Lang, B4	Brougham...	2,950	4	92	Opt...	33x4½*	Opt., 41....	153	60–100	Hertner....	Worm.....	6	Lever
Rauch & Lang, J4	Coach.....	3,100	5	96	Opt...	33x4½*	Exide, 42..	153	60–100	Hertner....	Worm.....	6	Lever
Rauch & Lang, TC	Town Car....	3,800	7	105	Opt...	33x4½*	Exide, 41..	153	50–80	Hertner....	Chain.....	6	Wheel
Standard, M	Coupe.....	1,990	4	96	Pneu..	33x4	Exide, 30..	140	60–80	West'h'se...	Bevel.....	6	Lever
Tiffany, M-2	Coupe.....	2,500	4	100	Pneu..	33x4	Williard.30	135	75	Wagner....	Worm.....	6	Lever
Waverley, 105	Brougham...	2,800	4	106	Opt...	34x4	Opt., 42....	162	75	Own.....	Direct.....	4	Lever
Waverley, 104	Brougham...	2,900	4	106	Opt...	34x4	Opt., 42....	162	75	Own.....	Direct.....	4	Lever
Waverley, 107	Brougham...	3,150	4	106	Opt...	34x4	Opt., 42....	162	75	Own.....	Direct.....	4	Lever
Waverley, 102	Limousine...	3,500	5	109	Opt...	34x4	Opt., 42....	162	75	Own.....	Direct*b*....	4	Lever
Woods	The 1914 models of this make have not been announced up to the time of going to press												

*Pneumatic size given. *b*Double herringbone reduction.

struction are unaltered. Both front and rear of the frame are underslung, and the spring suspension is of the same type as used on the other model.

This model has only the rear drive and does not incorporate the new type of controller lever. This is horizontal and parallels the longer steering lever. The body is not quite so large as that of the model LB. There are revolving front seats allowing the passengers to face either way. These are not so large as in the later model, being 15½ inches wide and 16½ inches deep. The door width is the same, but the roof is slightly lower.

The battery is a thirty-cell type and with a Westinghouse motor suspended at three points similarly to that of the other car, this model SB has the same mileage possibilities. Its speed is also the same. Except for the mounting of the frame underslung entirely, the same general chassis characteristics are in evidence as used on the larger car. Model SB has a wheelbase of 96 inches, and its axles are also Timken. The no-oil feature is also made use of.

Tires are also Motz as standard, but they are 36 by 4 inches. The lamp equipment matches that of the larger model, while the other extras such as speedometer, Klaxet signal horn, toilet case, smoking set, cut glass flower vase and tool outfit are also in evidence on this as on the other car.

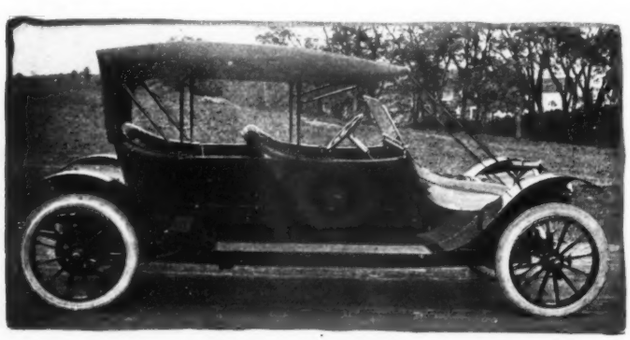
Chicago Electric Motor Car Co.

Chicago electric passenger cars are continued in three body styles for the 1914 season, these incorporating few changes, in other words the original designs are being adhered to pretty closely. The company has one model which it describes as a new type with rear-seat drive, which is an evolution of a present model with the seating so arranged that instead of a solid front seat extending across the front of the body on which the occupants face rear, there is a single solid seat on the left and a revolving chair seat on the right, which means that four passengers can now face forward, that is, three on the rear seat and one on the revolving seat at the right of the operator.

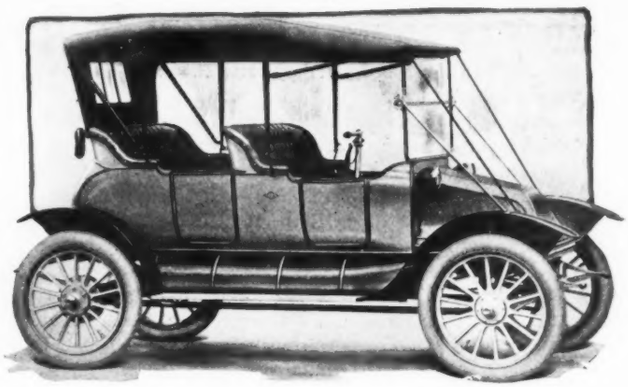
In the bodies only slight changes in structural details, fixtures, and trimmings are noted, the company not listing any types with dual control.

Battery equipment as used in 1913 remains unchanged except that the non-wash cell is used, this having 3.25 inch mud space at the base of the grids. The equipment in all three models is forty cells eleven-plate Hycap-Exide which differs from the regular Hycap in that the Hycap connector is not used but a special copper-core flexible connector takes its place. One year ago this company introduced battery accessibility by so mounting it to allow of sliding out one tray at a time without having to lift them over any obstructions. The battery continues to be suspended beween the front and rear axles rather than above them. Twenty cells are carried in the front and twenty in the rear. With this battery location the company claims to carry it at an average of 14 inches closer to the ground than where it is mounted over the axle, thereby lowering the center of gravity of the car.

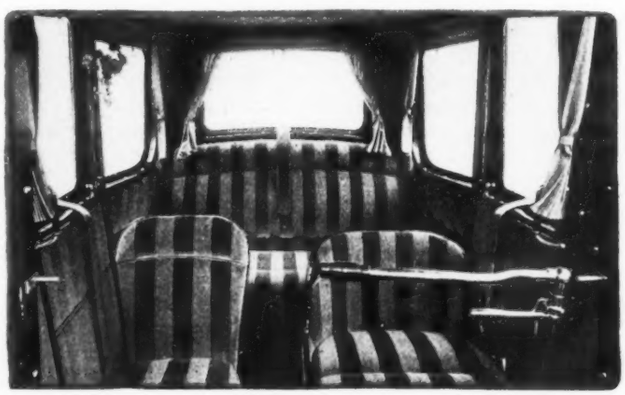
On all models a low-speed motor is used, making 900 revolutions per minute with a car at 18 miles per hour, and between this motor and the rear axle is a single gear reduction of 5 1/13 to 1. In this low-speed motor is claimed maximum efficiency with minimum weight, the claimed advantages including reduced wear on bearings, brushes, and commutator. For hill-climbing the advantage advanced is a reduction of heating tendency, due to low speed.



New Bailey model F four-passenger roadster, chain drive



Fritchle five-passenger touring car. Price $2,500



Seating arrangements of Fritchle for front seat drive

Drive from the motor is direct by shaft with a floating Timken-type axle built specially for this coupling.

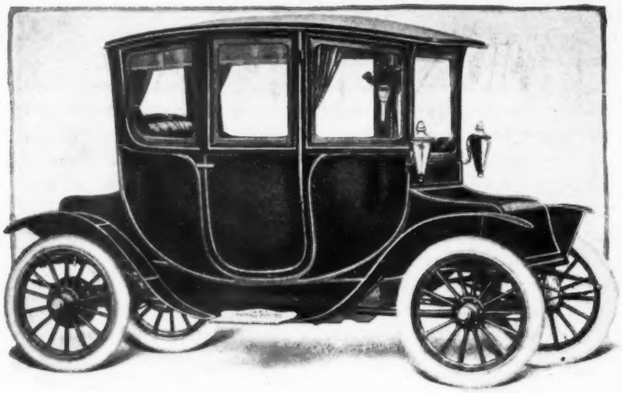
The controller is a continuous torque-type with magnetic blowout, and uses large copper surfaces and heavy wiring. Locating it directly against the motor reduces the wiring length, and makes both motor and controller accessible through a door in the car floor. Five forward and reverse speeds are provided and control is such that the reverse cannot be brought into operation until the brakes are applied, thus insuring the car being stopped. The ratchet lever brake is inter-connected with the electric cutout, making it necessary to bring the controller back to neutral before engaging other speeds.

The Chicago chassis was designed primarily for solid tire use, and in this connection a pressed steel frame is used with side members 4 1/16 inches deep, these being reinforced by eight cross members. Wheels take 36 by 4 Firestone dual-tread tires, and with these the speed range is from 5 to 22 miles per hour.

Concerning the individual models: Model 141, a rear-drive car, with 96-inch wheelbase is a five-passenger inclosed type, the body measuring 70 inches inside from glass to glass. The rear seat is 53 inches and the front seat 20. This vehicle can be turned in a street 34 feet wide and is recommended for use where three to four passengers make the general load.

Model 143 is practically the same as 141, excepting that it has the revolving chair front seat at the right.

Model 142 is a front-drive with limousine lines, having a rear seat wide enough for three passengers, and the operator seated in a Pullman type chair at the left, and to the right of this a fifth folding seat, which is entirely out of the way when not



Fritchle five-passenger brougham, forward drive, new model. Price $3,600

Century seating arrangement for duplex drive; at left, seats arranged for rear seat drive; at right, control arrangements for front seat drive

in use. This model is built on 104-inch wheelbase and has an inside body length of 78 inches, yet can be turned in a 38-foot street.

In all bodies aluminum is used in the panels with hardwood framework. The arched door is a feature of design.

The Fritchle Auto & Battery Co.

This Denver concern continues its line of four-passenger types which range from a Torpedo roadster at $2,400 to a five-passenger Torpedo touring car at $2,500 to a five-passenger Colonial brougham at $3,600, and a four-passenger Colonial coupé at $3,000.

In all of these the Fritchle battery is used, consisting of 32 cells 15 plates to the cell. The improvement in this battery is that by using thinner plates 15 can be used instead of 11, and by this change longer life, greater capacity, and reduced weight are obtained. No change has been made in the battery support in that the Fritchle battery has always been carried outside of the body leaving every cell accessible for inspection and attention.

An important change throughout the entire Fritchle line is the use of worm-driven rear axle, by means of which there is direct drive from the motor to the axle with a single reduction.

The running gear is practically the same as adopted by this company at its inception and includes four elliptic springs, two front and two rear with reach rods connecting the front and rear axles. Tire equipment is 34 by 4 on all models, except the roadster which is 34 by 3½.

The mileage per battery charge on the roadster is placed at 100; on the Colonial brougham 70 to 90; on the touring car torpedo 70 to 100; and on the Colonial coupé 80 to 100.

Control in all models is through a horizontal lever which is concentric with and mounted on the steering column. The control furnishes five forward speeds on all of the various models.

Fritchle equipment includes the Fritchle milostat, Leston meter, and standard tool equipment.

There have been few if any changes made in the bodies excepting in where new designs have been brought out.

Grinnell Electric Car Co.

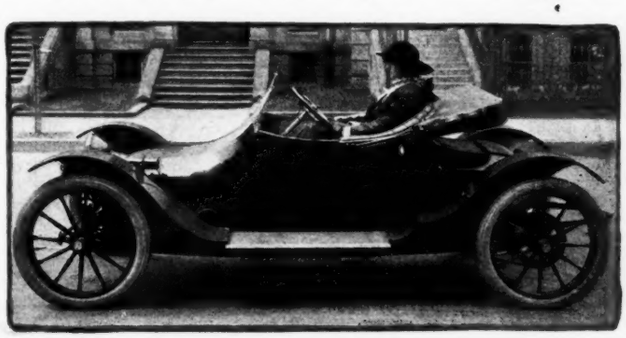
A general refinement program has been carried out on the three Grinnell electrics for next season, two of which are new models, and one a 1913 type with improvements. Model R, a five-passenger French brougham is the leading new model and possesses not a few characteristics, one of which is the new duplex drive, in which but one set of control parts is used, these being provided with universal joint connections permitting of them being swung forward and anchored to the side of the body to drive from the front seat or swung backwards and similarly anchored to the side of the car when driving from the rear seat. To make this shifting of control parts possible the controller lever rod and steering rod are each provided with two universal joints, one joint immediately below the handles, and the other joint at the floor. The speed control lever, the steering rod, and the current lock switch are mounted as a unit and can move together, forward and backward according to which control is needed. The illustrations on a previous page showing this control in both forward and rear positions show a short ball-topped lever, immediately below the control levers, which is the locking means for anchoring the control into one of two sockets fixed on the side of the car. This ball-top lever controls a tongue which fits the socket and with the lever vertical the tongue is free to enter or leave but when the lever is clamped down the tongue is locked in either socket.

This dual control calls for two sets of pedals in the floor, and to prevent the non-used set being used a suitable box is provided which covers them.

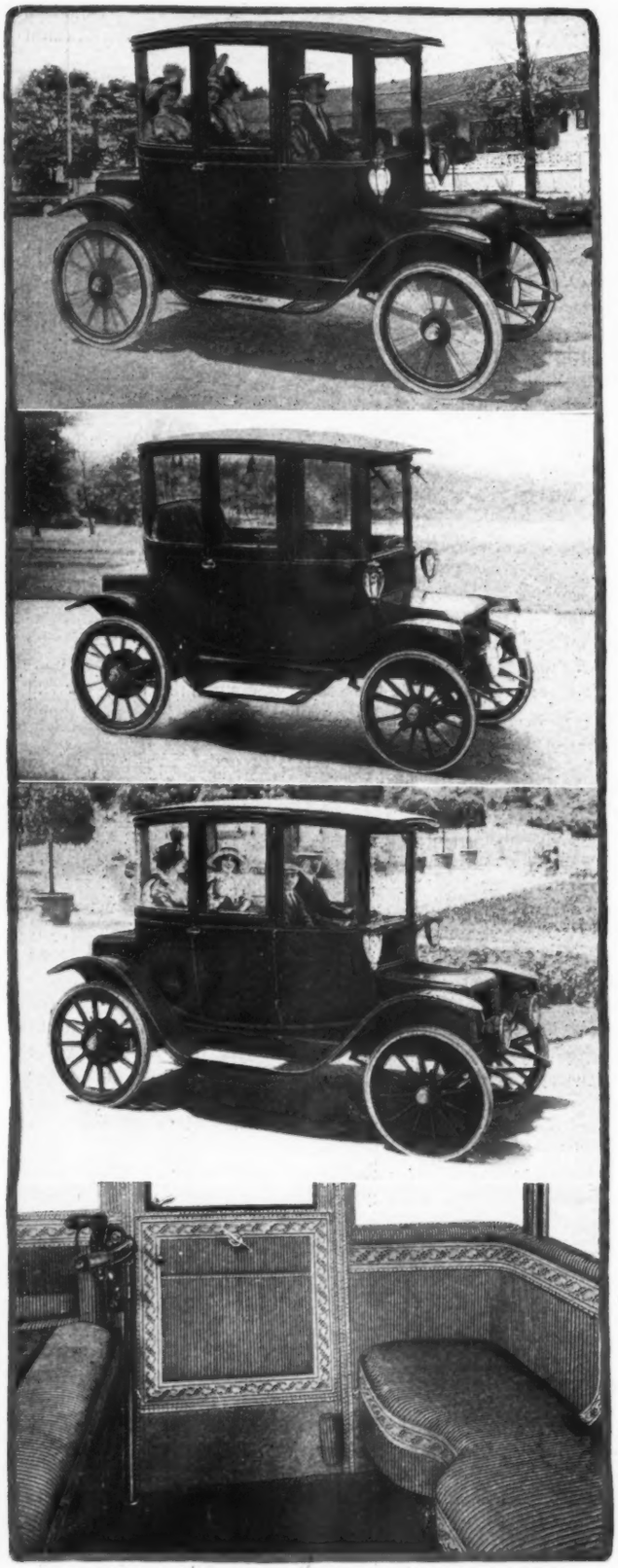
This model has the new horizontal control which the Grinnell company is using on both of its other models. With this short horizontal lever a progression of forward movements gives the four speeds ahead, and the fifth speed is furnished for specially fast running, 21 to 22 miles per hour, and when this is used, the controller handle has to be held in the fifth position and as soon as the holding force is removed it immediately returns to fourth position which is 18 miles per hour, a speed sufficient for ordinary use. A feature of the control is the automatic cutout accomplished by the service brake pedal in that depressing the pedal cuts off the current irrespective of the position of the controller handle, and before any speed can be engaged the controller must be returned to neutral and moved progressively to the different speeds.

All Grinnell models for next season carry the thin plate U. S. L. batteries of the non-wash type, there being sufficient mud space below the grids to care for all of the active material in the plates. These batteries are given a guarantee of 10,000 miles use within 2 years, and by fitting a new set of plates at that time an additional 2-year guarantee of 10,000 miles may be had.

Not a few body details have been improved for next year. In the French brougham window space is considerably larger



Bailey model F two-passenger roadster



Three models of Woods' electrics for 1914; looking from the top of the page, the three models are known as 13-32, 13-34, 13-33 and sell for $3,000, $3,100 and $3,200, respectively. At the bottom of the page an interior view of model 13-35 is shown; the exterior of this car is the same as model 13-34. The price is $3,000. The Woods line includes a new runabout type illustrated on one of the opening pages of this article

than heretofore; anti-rattlers are used on all windows including doors and windshields; the door windows have mahogany sashes which are not affected by the weather and these sashes rest on knife-blade supports which exclude any water. In the new windshield scheme there are two upper glasses. The outer glass can be set at any angle to prevent rain or sleet fogging the inner one, thereby giving a clear-vision effect; and if necessary for ventilation both can be opened at any angle. The lower half of the front glass drops out of sight.

Chassis lubrication has been cared for by the addition of grease cups to all working parts such as springs, steering parts and universal joints.

Attention is given Grinnell equipment in that all models carry the Sangamo ampere-hour meter; speedometers in which the drive is taken from the armature shaft, and a complete lighting equipment.

Model S, a new five-passenger brougham, is made with 100-inch wheelbase and fitted with 34 by 4.5 Motz tires.

Model K, the only carried over model, is a four-passenger brougham 94-inch wheelbase, and 34 by 4 tires. This model uses a double-reduction drive between the motor and rear wheels whereas in the other two models shaft drive with single reduction is used. Two universal joints are used in the propeller shaft of all models. A comparatively low speed Grinnell design of motor is used, its working speed being 900 revolutions per minute.

Ohio Electric Vehicle Co.

Ohio electrics, in three models, practically enter the 1914 selling year with no appreciable change. Designated as models O, M and Y in 1913, they will be known as models 40, 50 and 60 respectively for 1914. The chassis has a wheelbase of 98 inches and standard tread. Two of the body types, namely, models 50 and 60, have the double-drive feature which was used by the Ohio company this year. Model 40 is a single-drive car, its front seats being pivoted so as to turn in any desired direction, same as used in the other two models.

In the bodies, the most noticeable difference is in the use of sashless windows instead of the framed variety fitted to the cars in 1913. The glass plays in felt-lined grooves in the window casings. The bodies as a whole are well finished and upholstered and conform to the general trend of design for this class of vehicle. Sheet aluminum is used in the making of the bodies, the roof being a single sheet. Besides the usual long list of equipment within the luxurious bodies, the new Ohio models are furnished with electric heaters for the winter. These heaters, one of which is placed in each of the front seat pedestals, instead of being placed along the front in tube form as heretofore, are of the resistance type.

The chassis embodies an overhung cold rolled pressed steel frame of channel section suspended on semi-elliptic front and three-quarter elliptic rear springs. The front axle is a drop-center I-beam and the rear axle is of the floating construction, the weight carried on the housing. Hess-Bright ball bearings are used throughout the axle and wheels.

A special feature of the Ohio chassis construction is the suspension of the motor by a ball-and-socket joint amidships of the frame. The torque tube inclosing the drive shaft fastens rigidly to the end plate of this motor through a yoke. At the rear end, this torque tube bolts to the rear axle housing, thus the rear axle, drive shaft and its housing and the motor form one rigid unit. There are no universal joints in the drive shaft in this construction, the motor's ball-and-socket mounting allowing it to align with the rear axle at all times. With this direct-shaft construction, the reduction between motor and rear wheels is 4 to 1. The motor is a slow-speed, series-wound type of exceptionally large size.

Battery equipment on the new Ohios shows no change over the present cars. The standard equipment is forty cells, 13-plate Exide. Non-wash jars are used, making it unnecessary to wash them out during the life of the plates. When specified, Edison battery is furnished at an additional cost. The battery is car-

ried in the usual compartments front and rear. Double external contracting brakes act on the rear wheel drums. All models are equipped with an automatic current cutout on the emergency brake. When the pedal is pushed downward applying the brake, this operation automatically cuts out the current to the motor. After the brake is released, the power is not automatically turned on again, however, the car remaining still until the controller is brought back to neutral, after which it operates as usual.

Ohio electrics are fitted with either 34 by 4.5 inches special electric pneumatic tires or 36 by 4.5 inches Motz cushion tires. These sizes remain unaltered as compared with 1913 models.

The control of the Ohio is unique in that a small hard-rubber disk replaces a control lever. This disk is mounted on the end of the controller and is turned in either direction from a neutral point to give forward and reverse speeds. Besides the speed-regulating disk, the control head embodies within it integrally a bell button for warning signal, the controller lock button, and magnetic brake button. All of these are so close together on the control head that their operation by the left hand is a simple matter, leaving the right hand free for operating the horizontal steering lever. In the double-drive models, the control and steering lever are in duplicate as well as the pedals. The steering lever not in use swings down against the body and out of the way. The steering post is carried on ball bearings, making its operation possible with the minimum of effort.

Rauch & Lang Carriage Co.

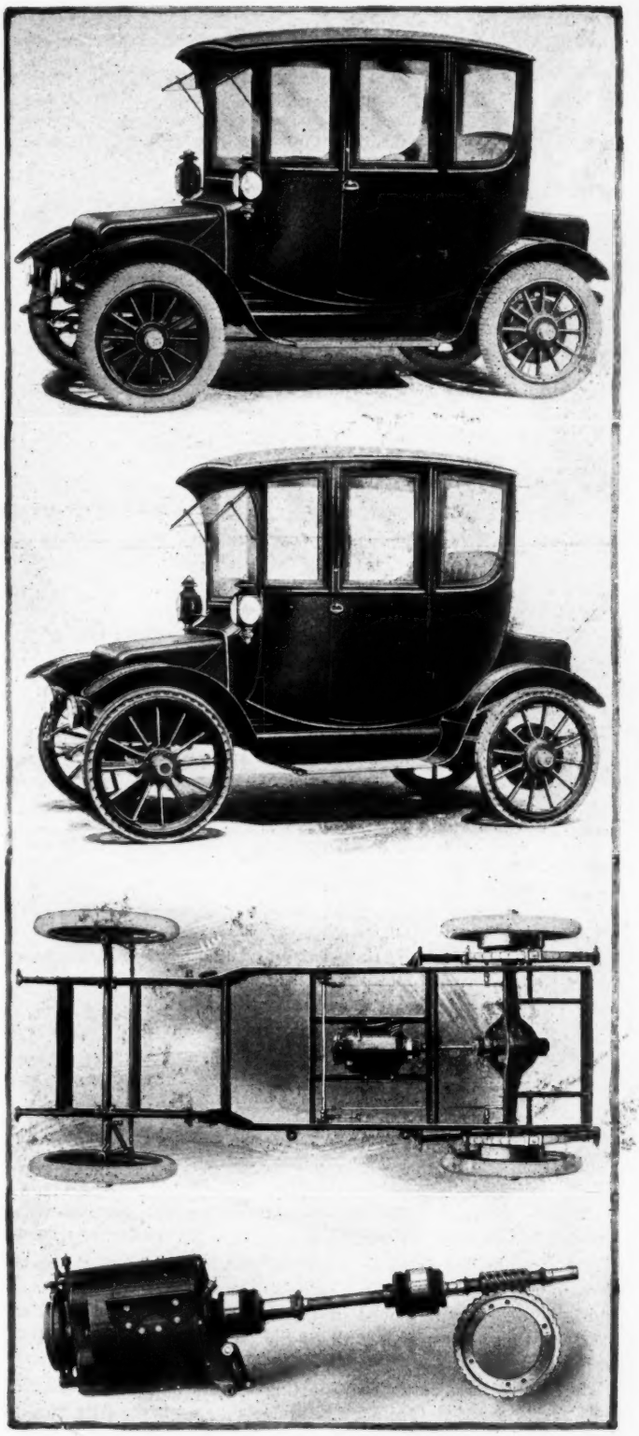
Progress in the R. & L. electrics is best evidenced by the introduction of worm drive used on all types with the exception of the town car, which maintains its present silent chain and bevel gear form. The worm-drive adopted is that in which the worm is mounted above the wheel, in other words, above the axle, leaving more axle clearance than is possible with a bevel-driven vehicle. With this new type of rear axle, it is possible to use a relatively high-speed motor in that a gear ratio of 8.6 to 1 is possible at the axle, this being the only gear reduction needed, the introduction of the worm thus marking the final chapter in the use of double-reduction systems between motor and rear wheels by this concern. The new rear axle has been made an engineering job. The straight-type worm is carried on annular bearings before and aft and at the rear of the worm are two-ball thrust bearings. The worm is a five-thread type and the wheel a phosphor bronze ring type. Both are carried in a cast-steel casing forming the differential housing and into this the two nickel steel axle tubes are secured. End thrust bearings for the differential are carried.

Next in importance to the general introduction of worm drive is the new coach with dual control which the company is listing, this model being a five-passenger type with steering from either the front seat alone, from the rear seat alone, or from both seats by the R. & L. dual system. As a dual control it lists at $3,200, with front or rear lever control at $3,100 and with front wheel control $3,150. In the dual control car there are two complete sets of control units but a safety precaution in the front-seat system is that the controller handle is mounted on the seat, which is a revolving type so that if the seat is in any other position except facing straight forward the drive is cut out.

In addition to its coach model there is a complete line of R. & L. vehicles ranging in price from $2,600 upwards. The open roadster is listed at this figure. Next comes the closed roadster with a coupé-design of body and listing at $2,800. Then comes the demi-brougham at $2,800, the brougham at $2,950 and last the coach already referred to.

The details, control, etc., of the 1914 R. & L. chassis were described and illustrated in THE AUTOMOBILE for September 18 and the cursory review of the chassis that follows serves only to draw attention to the leading factors.

Use is made of a bottle-neck pressed steel frame on which the motor is mounted just in advance of the rear springs and in such a way that its axis declines slightly forward in order to

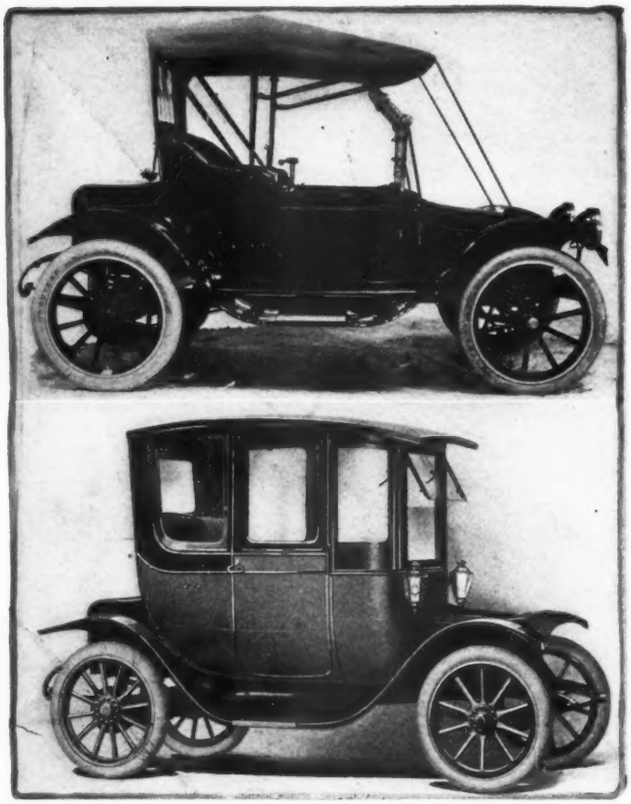


Lower Middle—Rauch & Lang worm-driven chassis used on the brougham illustrated in Fig. 36. Motor suspension, rear axle construction and bottle-neck frame are the features worthy of notice.

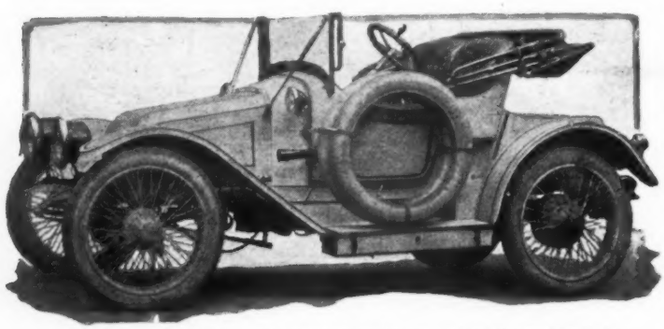
Bottom—Rauch & Lang motor and transmission system. This shows the motor and drive more in detail. The service brake is shown at the extreme left of the motor; the drive shaft has two universals, while the propeller shaft is mounted above the worm gear

Top—Rauch & Lang worm-driven coach, fitted with 33 by 4.5 pneumatic or 36 by 4-inch cushion tires at the option of the buyer. Full choice of control is given; the car may be had with either front, rear or double control. Its price with the latter is $3,200, and with single control it lists for $3,100.

Upper Middle—This cut illustrates the new worm-driven brougham made by the Rauch & Lang company to supply the growing demand for this type of drive



Standard electric roadster above and model M Standard brougham below



Buffalo runabout. The wire wheels are special equipment

give a straight-line drive through the propeller shaft to the axle. Two universals are used in the propeller shaft. The frame, in addition to being narrowed in front, is dropped in advance of the axle, thus exemplifying all of the latest tendencies in frame design.

The controller affords two starting speeds and four forward and reverse speeds. Ordinary running is done on the fifth speed, the sixth giving 20 miles per hour.

Standard Electric Car Co.

The Standard company is building but one type of electric vehicle and concentrating its efforts on this type, which is built in two-passenger roadster style with a 91-inch wheelbase, listing at $1,785, and also a four-passenger coupé with 96-inch wheelbase at $1,990. The chassis is a conventional layout with a pressed steel drop frame, the drop in front of the rear axle. This frame is supported on semi-elliptics in front and three-quarter elliptics in rear. The highspeed motor is located approximately midway of the axles, and the double-gear reduction used this year in the rear axle is continued, the first reduction being by bevel gears and the second by spur gears. No change has been made in the battery equipment, which consists of thirty cells Hycap Exide eleven-plates to the cell.

Standard bodies differ only in detail from those of 1913. They are practically of the same size and weight but improved in that concealed hinges for the doors give the outside a cleaner appearance and eliminate troubles of exposed hinges which arise from rusting and chipping of the paint. Sashless windows are now used on both models.

Tire equipment is the same as this year, namely Goodyear electric types 32 by 3.5 in front and 33 by 4 rear. When Motz tires are used 34 by 4-inch size are fitted.

The Tiffany Electric Co.

The Tiffany Electric Co. will continue to manufacture the distinctively designed car which was formerly known as the Flanders electric in exactly the same form and with a change in name only. The Tiffany is offered in one model only—model M-2—and with a wheelbase of 100 inches and a tread of 56 inches provides seating for four. The body is of the coupé design and the rear seat passengers face forward while those forward face the rear. No swivel seats are provided.

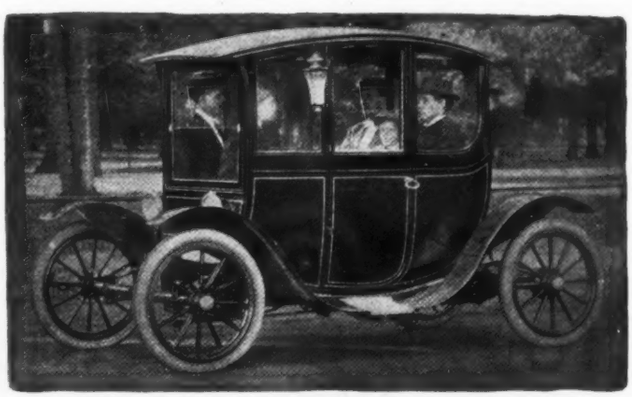
The chassis design is peculiar in that the series wound motor is directly attached to the rear axle. The drive is direct and does away with universal joints. The Tiffany uses a worm gear, the Tiffany company owning the patents of the Wallwork Worm Gear Co. The worm is mounted below the worm wheel and is bathed in castor oil at all times. Two Hess-Bright annular ball bearings carry the motor and at the same time take the thrust of the worm. The motor is set at an angle of 41 degrees.

The frame is overslung and mounted on overhung one-quarter elliptic springs. The front axle is tubular, and the three-quarter floating rear axle has a cast-aluminum housing. Both service and emergency brakes are internal expanding, manually operated. The Tiffany takes 33 by 4-inch electric pneumatic tires, Motz being furnished optionally at $100 extra.

The drive is from the rear seat, a steering lever and drum controller being provided. The latter furnishes six forward and reverse speeds. The battery, which is of Willard make, has an ampere hour capacity of 135 and gives approximately 75 miles on a charge. There are thirty cells, eleven plates to the cell. Twenty cells are carried in the front and ten cells in the rear. Each tray, of which there are six, carries five cells. No change has been made in the battery support. The Tiffany electric sells for $2,500.

Ward Motor Vehicle Co.

The Ward Motor Vehicle Co., New York City, will enter the pleasure vehicle field. A new chassis, embodying many new and radical features in Ward chassis has been designed, and experimental models tried out. What first strikes one in the chassis is the low drop frame, only 18 inches from the ground.



Tiffany brougham, showing body suspended equally between front and rear axles

This frame is connected to the front axle by the conventional semi-elliptic springs, but in the rear a brand new form is used. Back in the old coaching days such springs were used. Long leaves extend to a standard shackle in front of the axle, but as the spring extends to the rear, it curves upward until it doubles back and forms a complete semi-circle. Here in place of the long leather straps which our forefathers used, the Wards have placed a business-like shackle of sufficient length to give the spring full freedom. The leaves of the spring on the upturned portion are cut away on the opposite side to those on the straight portion because at this part the spring is superimposed.

The battery is carried at the extreme front of the chassis, but behind the front axle. The battery cradle is as low as the minimum clearance of the car allows, which with the low frame gives the car a very low center of weight. It is planned in the pleasure car to cover the forward portion of the battery with a French hood, while in the commercial designs the space above it is used as part of the loading space.

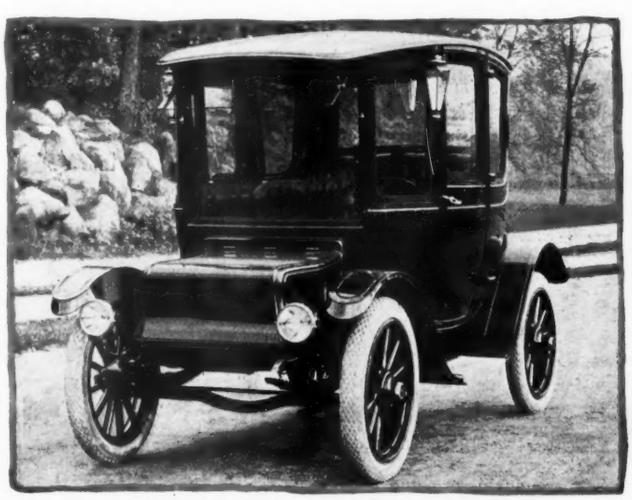
The Waverley Co.

Waverley electrics are in five models for next year, these ranging in price from $2,800 to $3,500. Of these five, two may be classed as 1913 models with improvements and three brand new 1914 types. Looking at the three new models which naturally represent the trend of progress with this concern, they are as follows: Front-drive, four-passenger car, $2,900; rear-drive four-passenger car, $2,800; and the duplex-drive brougham, $3,000. The exterior lines of these three new models are identical.

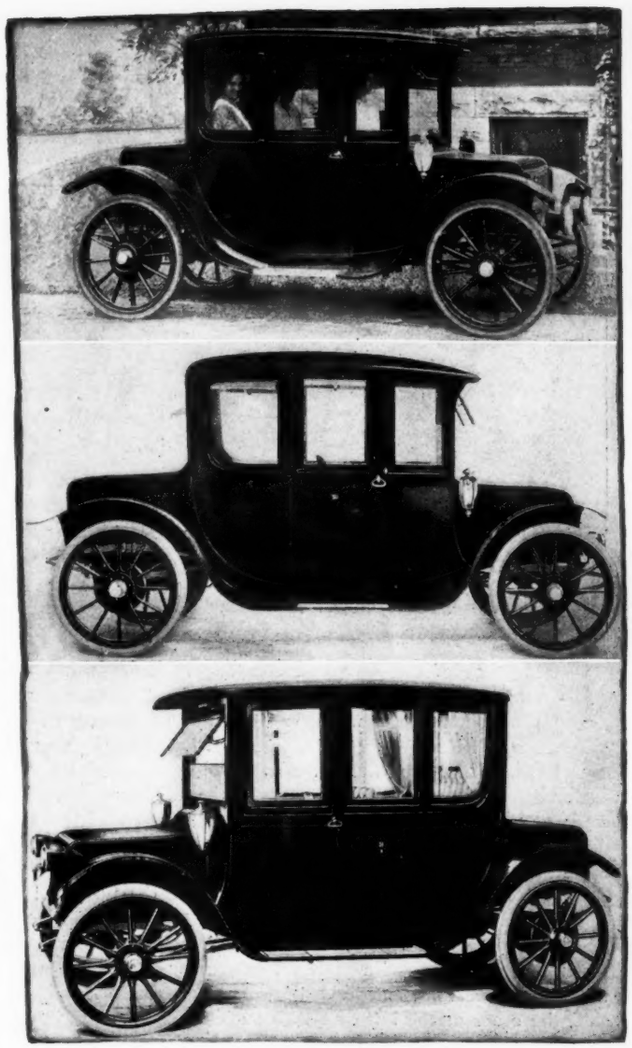
The two carried-over models, one a five-passenger limousine at $3,500, and the other a four-chair brougham at $3,250, contain several improvements over their predecessors of this year. In the limousine the body is hung much lower, and the left hand door instead of being opposite the right hand door has been moved forward in front of the driver's seat, thus giving plenty of room for the driver to enter and leave the car. The seat at the right of the driver, instead of being a sliding and folding one, is now a pedestal style in all respects similar to that of the driver. The decks covering the battery are now changed being 3 inches lower than formerly and different in their lines.

In the Waverley chassis the battery equipment all through has been slightly increased over that of this year. This year there are forty cells of battery but for 1914 forty-two cells are fitted with either eleven or thirteen plates per cell. The three new 1914 models are adapted to take sixty cells of Edison A-4 battery and the two carried over models sixty cells of Edison A-6.

No change has been made in the speeds of these models over those of this year, the limit being set at 20 miles per hour on hard level roads. These cars are all built for the use of solid or cushion tires, but an option is given the buyer on pneumatics, solid, or cushion.



Broc double drive model 36. Price $3,200



Top—Model 106 Waverley front and rear drive brougham. Middle—Model 104 front drive, four-passenger Waverley. Bottom—Model 108 five-passenger Waverley limousine

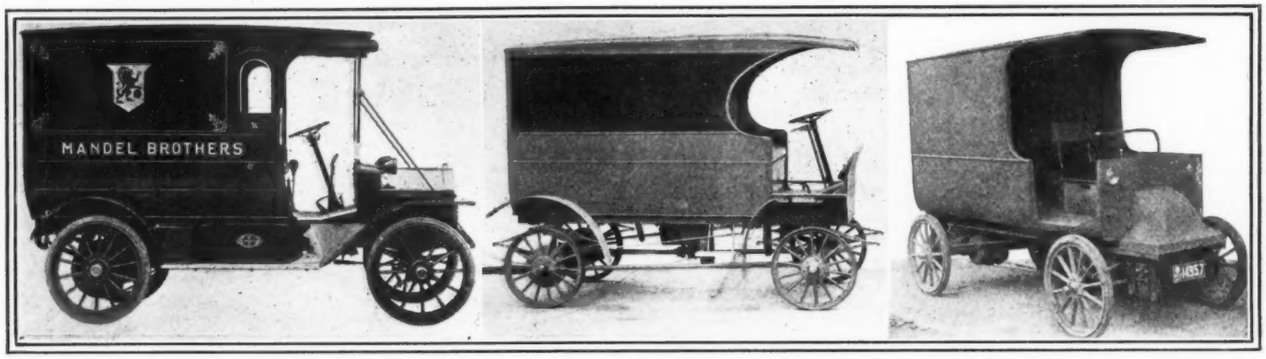
On the three new models the battery is entirely located under the hoods at the front and rear of the body, and no cells whatever carried under the seats, thus providing for ready inspection and battery repair without removing any of the cells from the car. The battery compartments are lined with sheet rubber seccured in place by metal strips, this rubber serving as a slight cushion for the support of the battery and also protecting the running gear from acid sloppage.

The Waverley method of transmission from the motor to the rear axle continues as at present, namely, silent chain reduction from the motor to the transverse propeller shaft and by herringbone gears from the propeller shaft to the rear axle. This location allows of a compact grouping of the drive units.

Woods Motor Vehicle Co.

The Woods company, has not yet announced its full line for the coming year, the only new model which up to this time has made its way to the market being a roadster. This car was first introduced a few weeks ago. It is a three-passenger car with a 92-inch wheelbase and is listed at $2,500 with complete equipment. The battery is carried in two sections, one in front and one in the rear of the chassis. The steering is by lever on the left side. Firestone dual-tread tires are used, the sizes being 34 by 3.5 inches in front and 38 by 4.5 inches in the rear. The rest of the Woods line for 1914 will be announced later.

Electric Trucks for 1914—Their



1,000-pound Kentucky delivery — Fritchle 1,000-pound delivery — Vanauken 1,000-pound wagon

Anderson Electric Car Co.

Full line 1,000, 2,000, 4,000, 7,000 *and* 10,000-*pound loads.*

THE policy of the Anderson company in its Detroit trucks and delivery wagons for 1914 is a fixed one, so far as production is concerned, and will mark the entry of this concern, which has been a leader in the production of passenger electrics, into the truck field in earnest.

Hand in hand with this new policy is the announcement of an entirely new line of vehicles including five capacities. All of these incorporate the new Anderson features of design. This group of models divides itself into two groups, shaft drive and chain drive. The two shaft-driven models are the 1,000 and the 2,000-pound types, the others chain driven. The chassis layout in chain-driven and shaft-driven types is alike and quite different from the present models. The battery is mounted under the frame amidships, but divided into two trays, one at the right side, the other at the left and with sufficient space left between them to accommodate the propeller shaft, the motor being located ahead of the battery and between its forward end and the front axle. In the shaft-driven types the propeller shaft connects direct with the rear axle, using two universal joints and having but one reduction, namely at the axle. In the chain-driven models the propeller shaft transmits to the jackshaft located immediately in rear of the battery, and thence power is transmitted by side chains.

The Anderson company is grouping the controller, electrical instruments and lamps under a short curved bonnet in front of the dash, where they are well protected, well removed from the battery and most accessible, in that raising the hood discloses them all.

The merit of the new chassis arrangement is that the entire electrical system is grouped into a small space scarcely 4 feet square, that is, the wiring from the battery, the electric motor and the controller. So grouping all of these essentials cuts down the amount of copper wiring and consequently reduces the voltage drop between the battery and the motor. But you can add another advantage to these grouping systems, namely, that the motor is entirely taken away from under the load platform, so is practically all of the wiring and the possibility of either suffering damage due to breaking through of the load platform or liquids leaking through is eliminated.

Dividing the battery adds to its accessibility as well as insures better attention. In the larger models, the battery is mounted in trays carried on rollers so that when the side of the battery box is opened, forming an extension platform, the battery tray can be pulled out onto this platform for inspection, for filling the cells with water and for testing. On each door is a catch to prevent the battery rolling off the door-platform and when necessary to entirely remove the battery this catch may be released and the battery rolled onto a truck or repair platform.

A departure in Anderson construction is that of using pressed steel frames in the chain-driven models, the side members of the frame being bottle-necked or narrowed in front to reduce the space needed in maneuvering. On all models the horizontal type of controller is mounted under the steering wheel, the latter being on an inclined column. On the steering wheel is a cutout switch.

Double mechanical brakes are fitted to all models. On the shaft-driven types there are double rear axle brakes, one set internal expanding the other set external contracting. On the chain-driven models the service brakes are contracting ones on the jackshaft and the emergency ones expanding types on the rear wheels. The emergency brakes are interconnected with the controller and when applied cut out the current making it necessary to bring the controller back to neutral before the current

G. M. C. delivery type — Commercial truck panel design — Commercial truck stake truck

Improvements and Characteristics

One thousand-pound Kentucky type | Walker 1,000-pound delivery | Ward delivery type

can be brought on. This brake has a ratchet for holding the brake applied.

The general equipment includes hub odometers and solid tires.

Edison battery is regular equipment on all models, the A-6 cell being used on the ton vehicle, having sixty cells with an ampere-hour capacity of 225; the A-8 cell on the 2-tonner with 300 ampere-hour capacity; and the A-10 cell in the 3.5-tonner.

Atlantic Vehicle Co.

In five capacities, 1,000, 2,000, 4,000, 7,000 *and* 10,000 *pounds.*

One new model has been added to the four 1913 Atlantic types for next season's market, this being a new 1,000-pound model brought out two months ago, which, taken in conjunction with the present models with capacities of 2,000, 4,000, 7,000, and 10,000 pounds, gives a well rounded-out line.

The new 1,000-pound model is a shaft-driven type employing a bevel reduction at the rear axle and marks the début of this company in the shaft-drive field. An option of battery location is permitted. The battery may be mounted under the driver's seat as now employed by one large maker of electric vehicles, or it may be mounted beneath the floor if the purchaser so desires. The battery equipment is either forty-four cells Exide or Edison A-4 or A-6 cells according to the requirements of the purchaser. This new model has a speed of 18 miles per hour empty and 15 miles per hour with load. The motor suspension is a three-point one and transmission from it to the axle is through a conventional propeller shaft with two universals. A new departure in frame construction is that of using pressed steel side members which are narrowed towards the front in order to reduce the diameter of the circle in which the truck may be turned. Timken axles are fitted. The tire equipment is 36 by 3 all around, with Goodrich or Goodyear solids and with the Motz cushion recommended.

On its carried-over models, namely, 2,000, 4,000, 7,000 and 10,000-pound types, few if any changes are noted and the prices are practically the same as this year. Approximately 15 per cent. greater mileage per battery charge is listed, due to reductions in chassis frictions, this being due to closer workmanship and better mounting of bearings, etc.

Argo Electric Vehicle Co., Saginaw, Mich.

1,000 *and* 2,000-*pound types.*

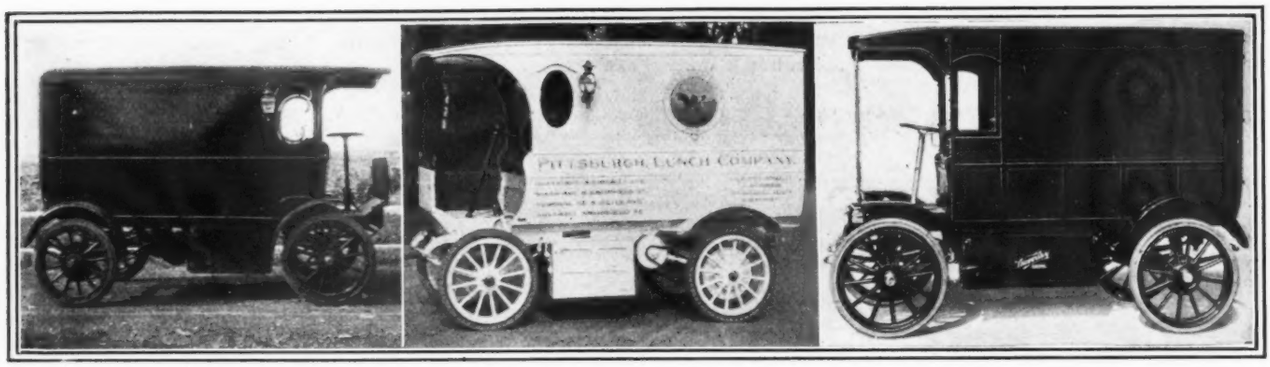
The Argo motor vehicle made in two chassis capacities, namely, 1,000 and 2,000-pound type, is designed to take three types of bodies for each chassis, namely, open express, platform stake and closed panel.

These vehicles now use an interlocking arrangement between the controller and the brake whereby the application of the brake cuts out the current. Tires are generally larger on both. The company is retaining the Western-Mott design of axle which it has used during the present season, but these axles are being strengthened for next year.

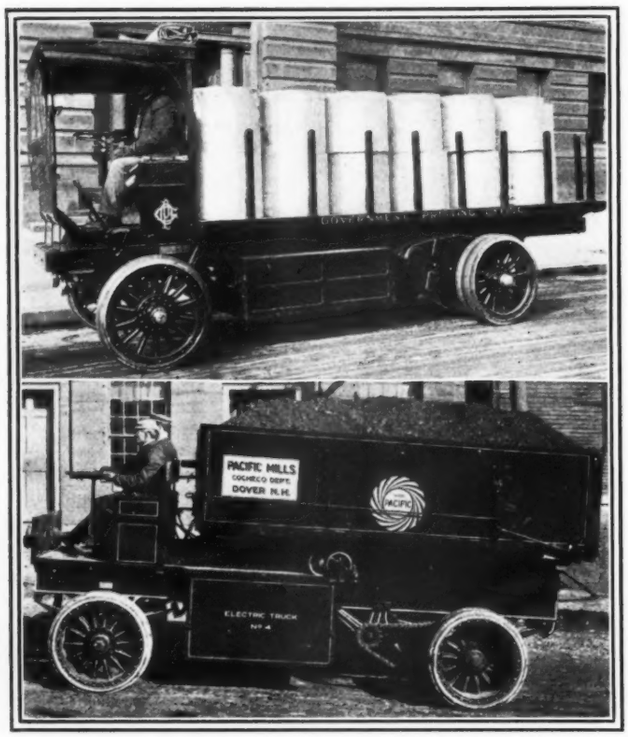
A complete double set of internal expansion rear wheel brakes is used. On the 1,000-pound model the brake drums, 12 inches in diameter and 4½ inches wide, accommodate the two expanding sets of shoes which are 1½ inches wide each, yet these drums are practically light, weighing but 14 pounds each. On the ton-model a similar brake arrangement is provided using 14-inch drums with the same face width and accommodating the same size of expanding shoes, these drums however weighing 19 pounds each.

On the 1,000-pound wagon 34 by 3-inch tires are regularly fitted and on the ton-vehicle 35 by 3½. It is Argo policy to

Baker 1,000-pound wagon | Atlantic 2-tonner | Ward delivery



Borland 1,500-pound type | Baker 1,000-pound model | Waverley 1,000-pound model



Baker 3.5-ton stake type above. General Vehicle chassis with coal body, below

furnish special electric solid tires or special electric cushion types according to the option of the buyer and although the company does not recommend the use of pneumatic tires these are furnished at the request of the purchaser.

Baker Motor Vehicle Co.

1,000, 2,000 4,000 and 7,000-pound sizes listed.

The program of Baker electric trucks, as far as it is possible to show in our specifications tables, includes four chain-driven models with capacities of 1,000, 2,000, 4,000 and 7,000-pound capacities. These vehicles are all alike in general chassis layout, using the underslung battery and single motor with drive from the motor to the countershaft through silent chain and from the jackshaft to the rear wheels through roller chains, these chains being enclosed in the heavier models.

In fitting bodies the company pursues its well-established policy of fitting any style of body that meets the requirements of the case. This policy applies to its entire gamut of models.

An optional battery equipment is listed of either lead or Edison cells, with the latter extra. The lead battery is made up of forty-two cells, generally arranged in six trays of seven cells to the tray. As the capacity of the vehicle increases the number of plates per cell is increased, thus in the 1,000-pound vehicle nine plates are used, in the 2,000-pounder, eleven plates, in the 4,000-pound model, thirteen plates, and in the 7,000 ponnd-model, seventeen plates. When Edison equipment is fitted the cells change, the list for the capacities showing A-4, A-6, A-8 and A-10 cells respectively being used.

All Baker vehicles are for 1914 fitted with pressed steel channel section frame members. The front axle is an I-beam type, the rear one rectangular in section.

Two sets of mechanical brakes are regular equipment, the customary location being a set of internal expanding brakes on the rear wheels and an expansion set on the jackshaft, with the exception of the 7,000-pound truck which has both sets expanding types on the rear wheels.

S. R. Bailey & Co.

Delivery wagons, 300-pound loads.

Two styles of commercial vehicles, both practically the same as used this year, are listed for next season by the Bailey company, one being the light service car which is the runabout with baggage-carrying facilities in rear of the seat and the other the 300-pound delivery wagon mounted on the roadster chassis. Battery mileage and speed are featured as leading points of consideration in both vehicles. The runabout fitted with 33 by 4 electric pneumatic tires on the 2-D rims has a body with inside dimensions 42 inches high, 42 inches wide and 44 inches long. This vehicle is equipped with either sixty cells of A-4 or A-5 Edison battery, the price being suited to the number of cells carried.

The light service car is specially intended for use in telephone, electric light and power companies. It is geared to 20 miles per hour with a mileage radius of 60 to 80 per charge.

The Borland-Grannis Co.

1,500-pound type not yet ready.

The Borland-Grannis company some time ago announced a 1,500-pound delivery wagon in open and closed body styles, but as yet it has not begun the marketing of this model and owing to the pressure of its passenger vehicle trade may be compelled to defer it for some months. This vehicle is included in the specification tables of this issue.

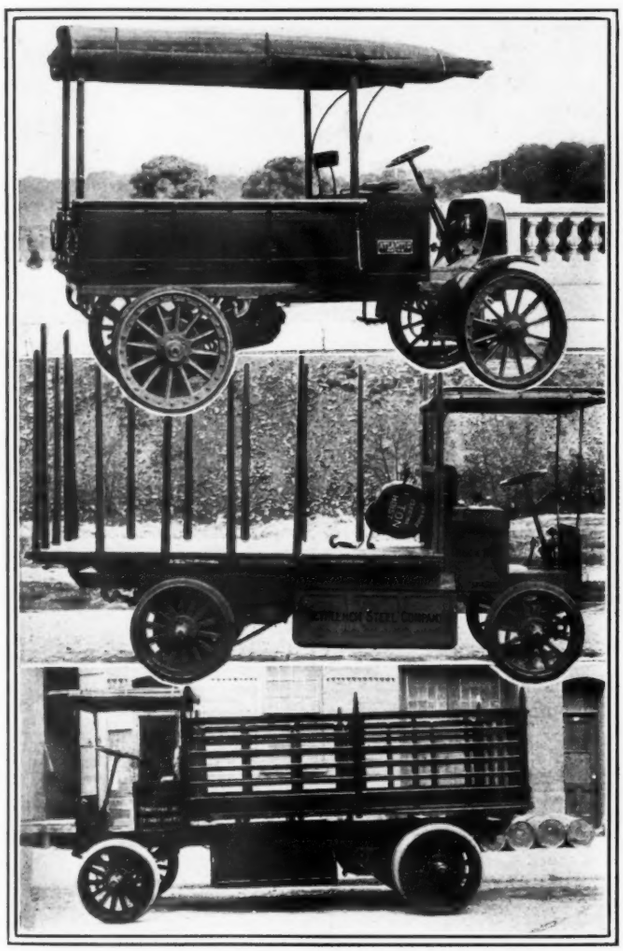
Buffalo Electric Vehicle Co.

Two models, 1,500 and 2,000 pounds capacity.

Buffalo electric trucks which have been built in 1,500 and 2,000-pound models during the present season will continue in these capacities for 1914 with few if any changes incorporated. The same design of chassis used in both has several characteristics, the chief one being forming the motor as a unit with the back axle by entirely enclosing the short propeller shaft and having the housing for the shaft forming a rigid uniting element between the motor housing and the axle casing. The necessity for a universal joint in the shaft is obviated by securing a universal action in the propeller shaft where it unites with the

motor by an internal gear clutching, in that the forward end of the propeller shaft carries a pinion which engages an internal gear on the motor, the meshing of one gear with the other giving the necessary flexibility.

The rear axle is a double-reduction floating type fitted with roller bearings. The front axle is a Timken product. The chassis combines in its makeup a pressed steel frame, semi-elliptic springs, and battery carried under the frame. Thin-plate lead batteries are used, forty-four thirteen-plate cells being used in the 1,500-pounder and forty-four fifteen-plate cells in the tonner. Buffalo vehicles are rated at 8 to 12 miles per hour with a 45 to 60-mileage range per charge. Mechanical braking is used, both sets being mounted on the wheels, the service set expanding, the emergency set contracting and both pedal applied. Tires are 36 by 3.5 S. A. E. standard.



Top, Atlantic 1,000-pound delivery with canopy top. Center, Atlantic 2-ton with electric hoist. Bottom, Atlantic 3.5-ton gate body

Commercial Truck Co. of America

Full line 1,000, 2,000, 4,000, 7,000 *and* 10,000-*pound capacities.*

The Commercial Truck Company's line is practically the same as this year in that all of its models have been continued, these ranging from a 500-pound delivery wagon to a 7-ton truck. Their line includes the following chassis capacities: 500, 1,000, 2,000, 4,000, 7,000, 10,000 and 14,000 pounds. A variety of drives are used on these vehicles, for example the 500 and the 1,000 pound wagons carry the motor under the chassis and drive by shaft to a worm-driven rear axle, the motor housing and rear axle being practically a unit, thereby eliminating the necessity of universal joints.

In the 2,000 and 4,000-pound models two motors are used for driving the rear wheels, one motor for each wheel, these driving through bevel reductions to internal gears on the wheel hubs. In the 7,000, 10,000 and 14,000-pound models all four wheels are drivers, each being equipped with its own motor which drives through a double reduction to the wheel hub.

With the four-wheel drive construction differentials are eliminated, and front as well as rear wheels are used for steering purposes. The axles in those models are of forged steel and made in two sections, separated by a spacing member. The motors are held between the axle sections or arms. Using four motors or four wheels gives a very equal weight distribution.

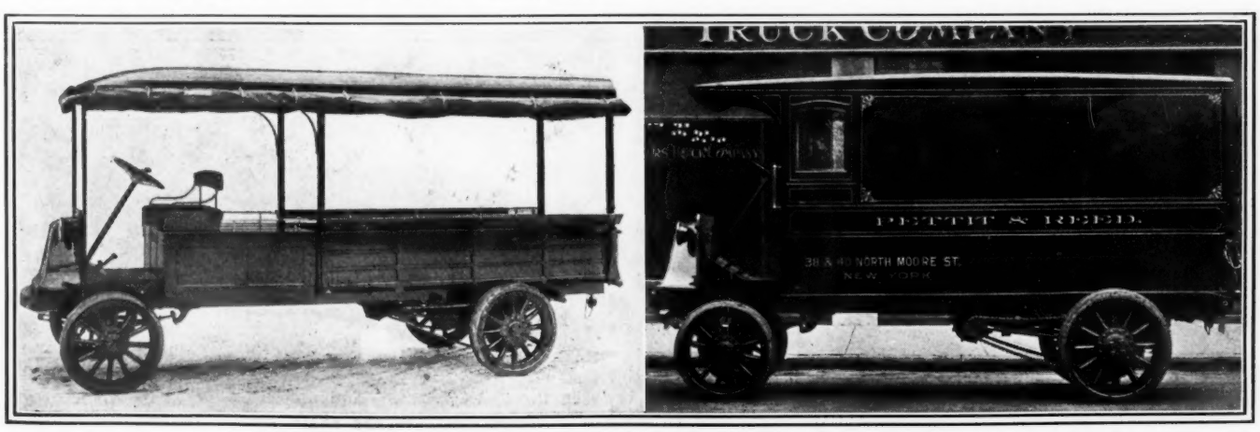
The C. T. models for 1914 will sell at a slightly reduced price as compared with this season. In this connection tires are generally larger and the company has standardized on 36 inch sizes for all models, the width of tire section being varied to meet load requirements.

Couple-Gear Freight Wheel Co.

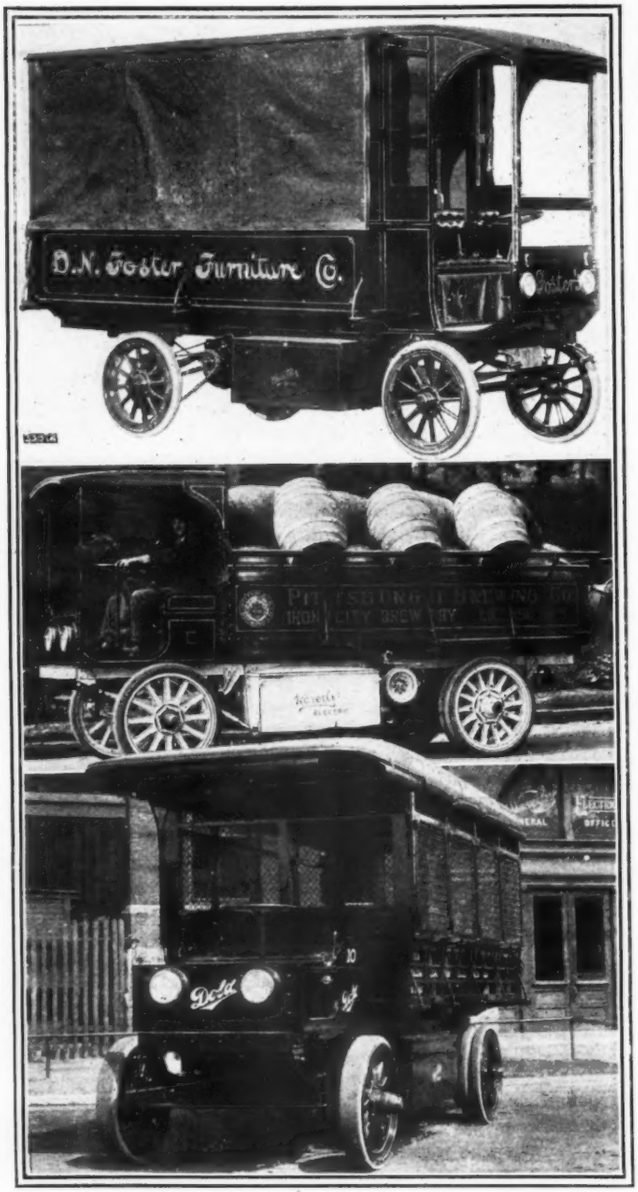
5,000, 10,000, 12,000 and 14,000-*pound capacities.*

Couple-Gear trucks continue to be manufactured with the motor incorporated in the wheel as formerly and for 1914 are listed in a variety of sizes ranging from 2,000 to 14,000 pounds capacity. The Couple-Gear Freight Wheel Co., in addition to supplying vehicles direct to the consumer, supplies its wheel unit to not a few concerns and large dealers who manufacture chassis to meet the requirements of the trade, the wheel construction giving every flexibility in this matter and making it possible to utilize parts of existing horse equipment by fitting a front axle unit comprising road wheels with driving motors and necessary battery equipment and control facilities.

The possibilities of the couple-wheel construction have been demonstrated in New York and Boston where the two-wheel tractor construction has been adapted to 5 and 6-ton loads, utilizing the horse equipment minus the front axle. For loads



Two G. M. C. motor types with battery located under and in rear of seat



Top, Waverley delivery type with driver's cab. Center, Two-ton Waverley for brewer. Bottom, Waverley 3.5-ton express body

ranging from 2,000 to 5,000 pounds, drive through two wheels is sufficient, but for capacities from 6,000 to 12,000 pounds all four wheels are used as drivers.

The wheel motors used in all capacities are rated at 3 horsepower and control is through five forward speeds and an equal number of reverse. Service brakes are external types operating on each wheel, the drum diameters measuring 17 inches with 2½ inch widths. The emergency brake is a controller type.

Chassis constructions are practically standardized and include semi-elliptic springs, I-beam frame constructions for chassis as well as tractors, etc. It is almost impossible to give battery equipment as this is generally suited to the requirements. On the 7-ton four-wheel-drive tractor forty-eight cells of lead battery containing twenty-five plates to the cell are used. This battery is divided into six trays of eight cells each, and may be carried either under or over the floor board. On the standard four-wheel-drive chassis for 10,000 pounds standard equipment is forty-four cells, divided into six trays, two with four cells each and four with eight cells each.

A new arrangement has recently been brought out by the Couple-Gear Co., known as its low-body vehicle, in which the floor of the body is 40 inches from the ground and the floor of the driver's cab but 28 inches. The driver sits in advance of the front axle and the battery is swung beneath the frame and between the axles. This new body arrangement gives an even distribution of weight over the four driving wheels. This vehicle, with a 3 1-2-ton dumping body, illustrated herewith, uses but 96-inch wheelbase and its overall height is 7 feet 3 inches.

Fritchle Auto and Battery Co.

One 1,000-pound model.

This Denver concern for 1914 continues its policy of 1913 by carrying over its 1,000-pound delivery wagon, the only vehicle it manufactures. This wagon has been quite overhauled, having gone through the transition from a chain-drive type to a shaft-drive variety with a bevel rear axle. It has also been improved in that it is regularly shod with 34 by 4 tires instead of 32 by 3.5 sizes used this year.

The Fritchle has since its inception been a user of its own batteries and motors, the battery being a lead type of thirty-two cells with 160 ampere-hour capacity and affording a mileage of 50 to 70 per charge. The battery weight is 900 pounds.

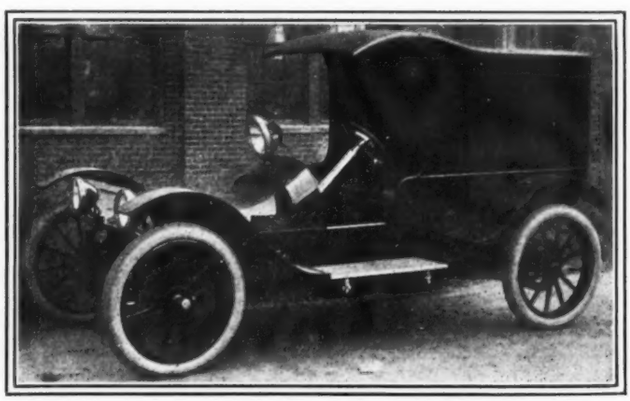
General Motor Truck Co.

Eight sizes, 1,000, 2,000, 3,000, 4,000, 6,000, 8,000, 10,000 and 12,000-pound load capacities.

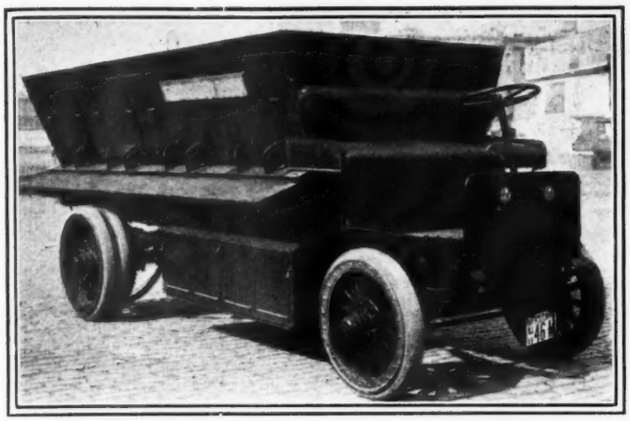
G. M. C. trucks are continued for next year along the same lines of design and production as this year and as has been followed since their inception. The company aims at producing these machines to meet the requirements of the customer rather than making the buyer's business fit the truck. To make a line of electric trucks adaptable to varied industries is no easy task and in solving the problem the G. M. C. people list eight models all fitted with a selection of three wheelbases giving a gamut of twenty-four capacities from which to select.

The capacity list rises in regular steps from 1,000 to 12,000 pounds as follows: 1,000, 2,000, 3,000, 4,000, 6,000, 8,000, 10,000 and 12,000. The three wheelbases are nominally known as A, B and C. Wheelbase A is the shortest and suited for heavyweight merchandise such as steel billets, etc.; wheelbase B is medium, suited for such merchandise as flour, etc.; and wheelbase C is the long one needed in furniture trucks, paper box trade, etc.

The G. M. C. company has had two objects in view in its design of truck, first the garage caretaker who has to look after the truck each evening and second the driver who controls it while at work. For the sake of the caretaker or garageman the battery is located high, under the seat, where it is accessible, easily inspected, easily filled with water and accessible for cell testing. The amount of battery equipment and the make of battery are determined by the buyer and the services to be given, the price being based on the equipment necessary. Fre-



Bailey 300-pound delivery



Atlantic 5-ton type with special body

quently the company experiments for some time on the most satisfactory battery equipment in case of large installations.

G. M. C. trucks all carry special electric solid or cushion tires according to the field of activities. In some cases the tire equipment is slightly larger than this year and in others it is not.

General Vehicle Co., Inc.

Six capacities, 750, 1,000, 2,000, 4,000, 7,000 and 10,000 pounds.

The six capacities of General Vehicle trucks and delivery wagons for next season represent carrying capacities from 750 pounds to 5 tons, the exact range including: 750, 1,000, 2,000, 4,000, 7,000, and 10,000-pound machines. Of this list the 1,000-pound shaft-drive vehicle is the only new one, this being radically different from previous models in that it represents the introduction of shaft drive with a worm type of rear axle, and incorporates still another innovation in that the battery is carried under a forward hood, occupying the same position as the motor in a gasoline car. It is fitted with solid tires and carries the various improvements which are being incorporated in the 1914 chain-driven models of the company.

Turning to the change of the models which are as mentioned above, several improvements are noted. To begin with the controller is now housed in an indestructible and fire-proof metal box. On this box is a new cutout switch in the form of a removable handle from 4 to 6 inches long, which handle the driver can remove when leaving the truck, thereby preventing tampering with it or further preventing irresponsible persons starting the vehicle in the driver's absence. This cutout removes the possibility of the vehicle being started when charging in the garage and further permits of mechanics working on the controller when the vehicle is being charged.

A further improvement is that the wiring is now carried in metal conduits, thus protecting it from water, acid or mechanical injury and at the same time eliminating the possibility of grounding the battery due to an injured wire. To this can be added the facility of replacing any damaged wiring without the necessity of removing the body or any other part of the vehicle.

Hand in hand with wiring improvement is that of using cartridge fuses in the lamp circuits in place of the open fuses used in the past. The cartridge type is safer from a fire standpoint and is easy to replace without any danger to the mechanic. Still further these new trucks are fitted with a plug receptacle for the portable or trouble lamp, the advantage being that the garage mechanic with this plug receptacle is enabled to quickly connect the portable lamp, without having to use the head or tail lamps for this purpose as in the past.

Looking towards the chassis other improvements are noted. Grease cups are more numerous, these being added to the spring shackle bolts, and their presence should add 100 per cent. extra wear to spring eyes and bolts.

From the driver's point of view the equipment with an emergency is especially appealing particularly in the heavier capacity machines in that it is an added safeguard when coasting down severe grades and tends to discourage the practice of some drivers using the controller of the brake which often results in damaging the controller as well as the motor and the battery.

For the driver's convenience a sheet steel tool box has been added and is mounted under the rear of the chassis where it is accessible to the driver without his having to interfere with any other part of the car.

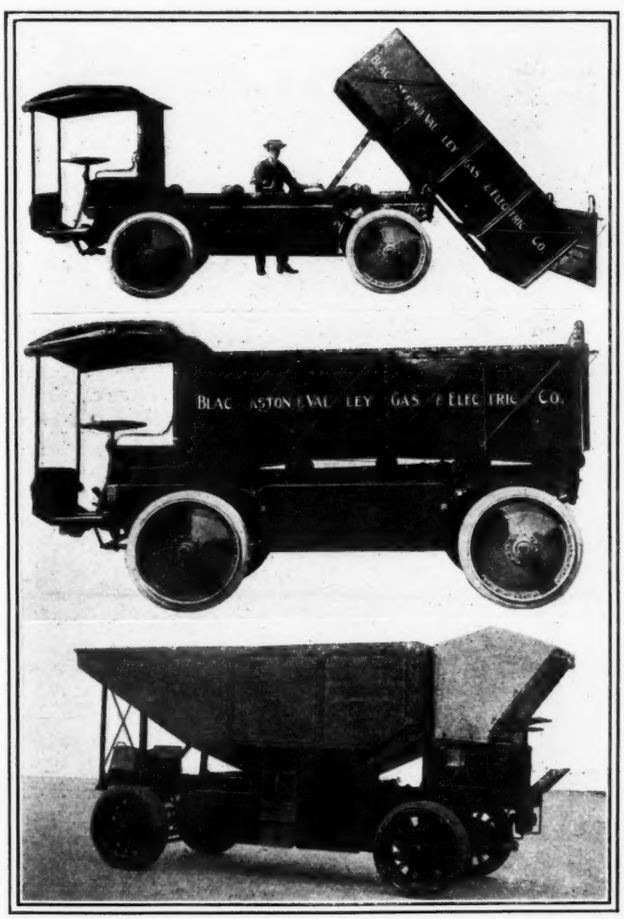
With the exception of these chassis refinements the chain-driven vehicles are continued practically as in 1913. Their battery equipment is the same; their load capacities remain unchanged; their rated speeds are as at present; and the general scheme of layout has not been altered.

Kentucky Wagon Mfg. Co.

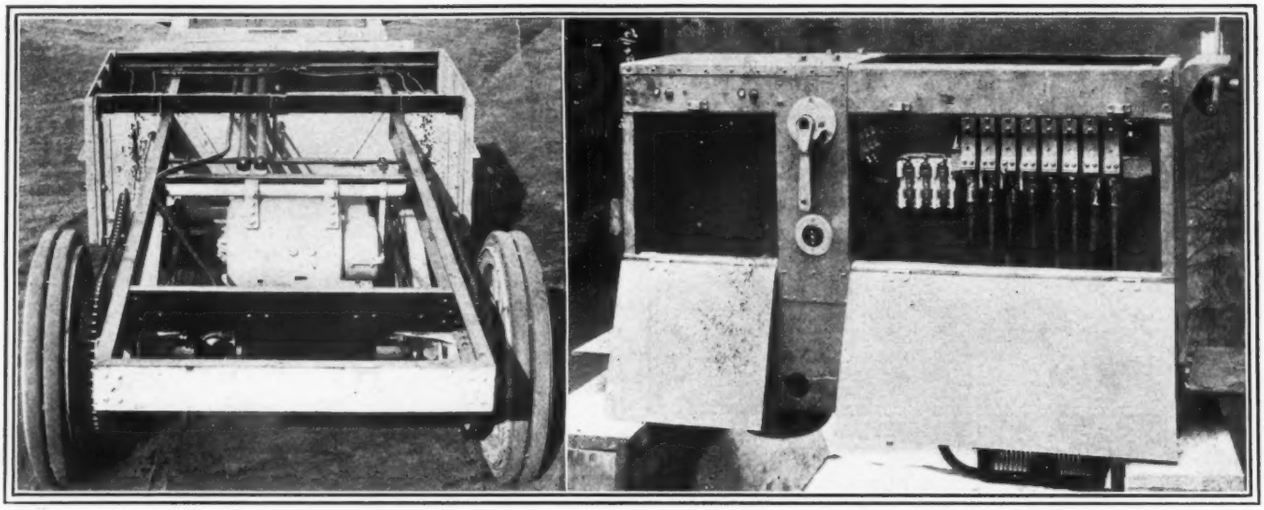
Urban trucks in 1,000, 2,000, 4,000 and 7,000-pound sizes.

Four models of Urban vehicles are listed for next year with capacities of 1,000, 2,000, 4,000 and 7,000 pounds, these capacities being the same as those of the 1913 vehicles. A few changes have been made, the battery equipment being the same, chassis details not having been altered and no changes in the method of driving being noted. These vehicles are characterized by pressed steel frames and driving from the motor to the countershaft by silent chain and by roller chain from the countershaft to the rear wheels. As usual with jackshaft construction the service brakes are contracting types on the ends of the shaft and the emergency brakes internal expanding types on the rear wheels.

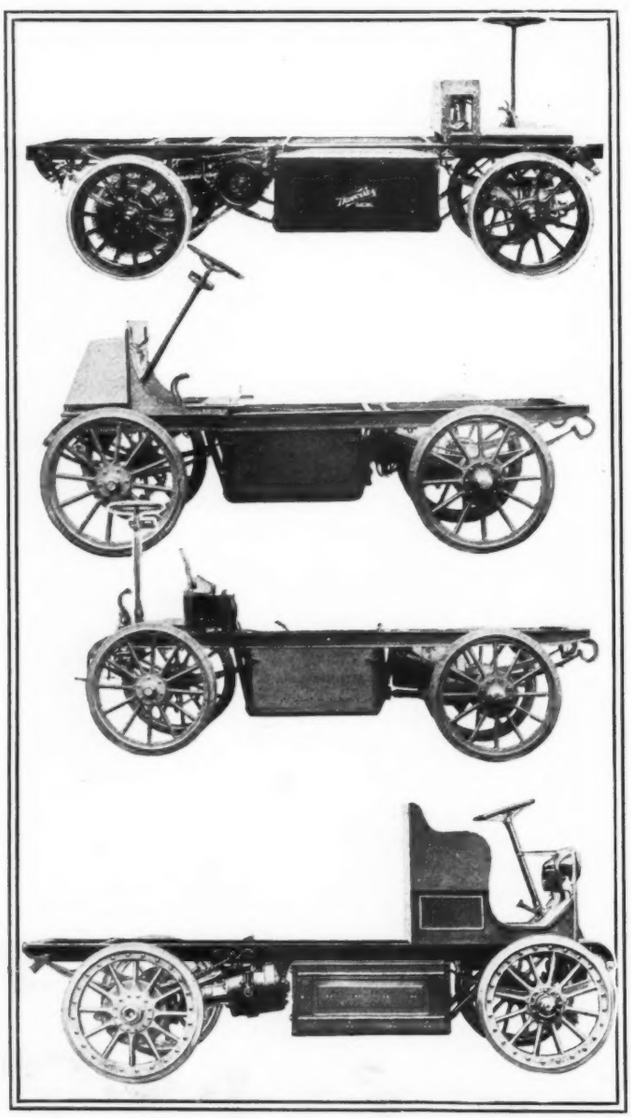
Batteries mounted beneath the frame have the battery box covered on top with a metal cap which is provided with a



Top and center, New Couple Gear coal type with low driver's seat. Bottom, Commercial Truck 7-ton coal truck



Showing wiring improvements on new General Vehicle and removable switch handle on controller box



Top, Waverley 1-ton chassis. Center, two views of Argo chassis, showing location of batteries and also two types of steering wheels. Bottom, Buffalo 1,500-pound chassis

capped vent hole, making it water proof. Between the battery and this metal cap is an insulating board and the sides and bottom of the tray are wood to prevent the possibility of battery grounding. Battery accessibility is furnished having the battery box side in the form of a door which when swung outward and down is supported by folding braces and permits the battery parts to slide out on greased metal strips. Openings between the floor boards are provided for battery ventilation, these being readily closed in cold weather by inserting wood filling strips provided for the purpose.

A lead battery equipment is listed giving a mileage of 35 to 40 on the 7,000-pound vehicle, 40 to 45 on the 2,000 and 4,000 types, and 45 to 50 on the 1,000 wagon. Thirteen-plate cells are used in the 1,000 and 2,000 pound machines, fifteen-plate cells for the 4,000-pound wagon, and twenty-one-plate cells for the 7,000-pound type.

Chassis constructions have been standardized by this company, these including S. A. E. wheel sizes for the tire equipment. Semi-elliptic springs are regularly used, all road wheels are carried on roller bearings, and ball bearings are used for the motor and jackshaft.

The controller handle is mounted under the steering wheel, and gives four forward speeds and two reverse on all models. Service brake control rests with the pedal at the right of the steering column and that for the emergency brake in a lever located in the center of the control deck.

These vehicles are equipped with ampere-hour meter and hub-odometer. The ampere-hour meter, controller, resistance, and electrical connections are readily accessible on removing the aluminum floor boards and the dash panel.

Van Auken Electric Car Co.

Two models, 750 and 1,000-pound loads.

This new Hoosier concern located in Connersville is making its début, with two delivery types, a 750-pound machine and a 1,000-pound vehicle, both alike in general features of design and are conspicuous with shaft driven and worm reduction at the axle. Hycap-Exide battery is located under the channel steel framework, and is divided into two trays of eight cells each. Part of the battery is carried under the front of the car and part under the rear. The battery is listed with a 45-mile radius per charge at a speed of 12 miles per hour, the fourth or high forward speed.

The Van Auken vehicles are both made with 80-inch wheelbases, carry 2-inch solid tires and are designed to turn in a circle with a diameter of 30 feet 6 inches, making maneuvering on streets free from the use of reverse when making a turn. There is but one set of mechanical brakes, a service set being

external bands acting on rear wheel drums in the usual manner.

The 750-pound vehicle is a closed type and the 1,000 pounder an open one. Both list at $1,000.

M & P Electric Vehicle Co.

1,000-pounds delivery is listed.

This Detroit company is listing a 1,000-pound shaft-driven delivery wagon to take the place of its chain-driven type which was brought out early this year. The new model will in most respects follow the scheme of chassis layout incorporated in the original vehicle and which possesses several meritorious features. In this design the battery is divided into two trays, one under the frame at the right side, the other under the frame at the left side, and with space between the two trays for the propeller shaft, the motor being mounted forward of the battery trays and immediately in rear of the front axle. From the motor the propeller shaft transmits direct to the back axle where a worm reduction is used. It is fitted with a Gould battery, the wheels carry 30 by 2.5-inch tires and the speed is 12 miles per hour.

Walker Vehicle Co.

Complete line 1,000, 2,000, 5,000 and 7,000-pound sizes.

The 1913 policy of the Walker company is being continued for 1914 in that approximately the same series of vehicles is being listed for 1914 as appeared in 1913 with the possible exceptions of variations of 500 pounds in some rated capacities. For next year the capacities are, 1,000, 2,000, 3,000, 5,000 and 7,000-pound vehicles, all alike in using the Walker drive, namely that in which the electric motor is incorporated within the back axle housing and drives to both rear wheels through the Walker balanced-drive system, a feature of the design which has been used since the start of the company.

In all of its vehicles an option of Edison or lead batteries is given with capacity a little large in the lead types, two cells being added in most of the models as compared with this year. The company lists an optional ampere-hour capacity this being determined by the service the vehicle has to meet. A 4-year guarantee is given with the Edison battery equipment.

Two sets of mechanical brakes are used. The service brakes being external types on the rear axle, the emergencies, internals on the same drums. The front spring suspension is a transverse type mounted over the axle. Pressed steel road wheels are used.

Ward Motor Vehicle Co.

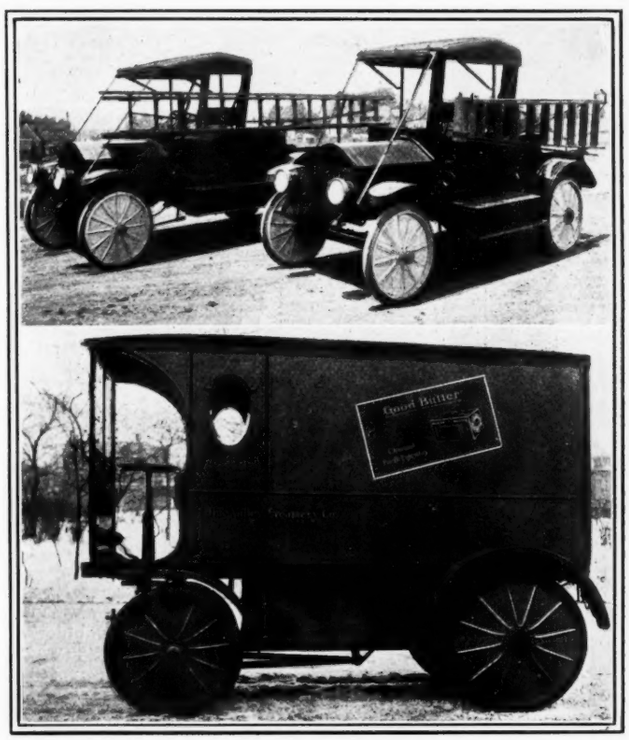
Capacities range from 500 pounds up.

The Ward electric made in five capacities, namely, 500, 1,000, 2,000, 4,000 and 8,000 pounds capacity is continued in nearly every respect the same as it has been marketed this year. These models have been on the market within the present season and all of them will be continued. In one important respect all are improved by the use of larger tires on both front and rear wheels.

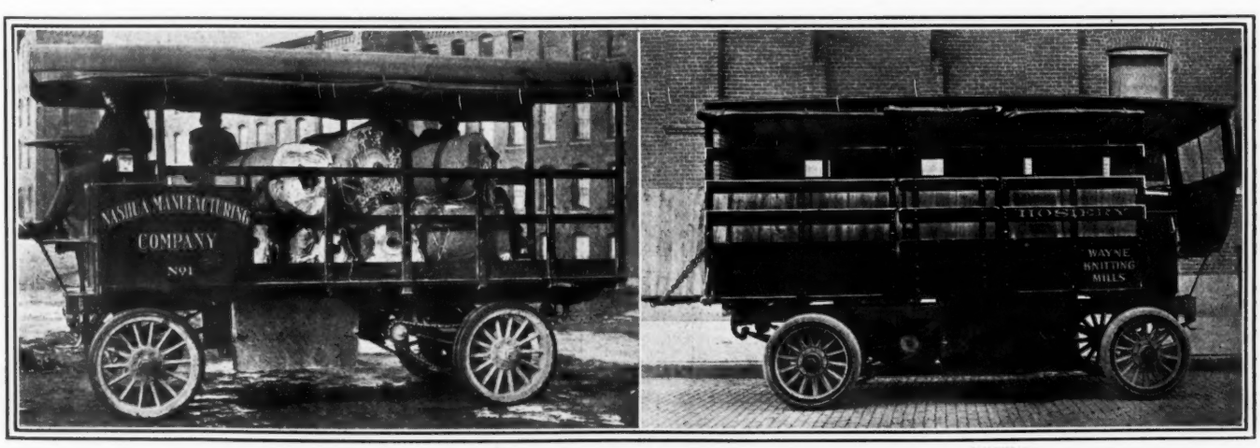
The real 1914 innovation of the Ward line is the new 500-pound delivery wagon which is built with the driver's seat midway between the axles and with one-half the body ahead of him and the other half back of him. The body is specially low, the floor being but 24 inches from the ground and the running board but 12 inches, a feature sure to be appreciated by drivers in house-to-house delivery work.

In this new vehicle the battery is carried immediately in rear of the front axle, and the motor immediately back of the battery, a position directly under the driver's seat. The controller is under the seat, so that battery, motor and controller are well grouped. The drive from motor to rear axle is by shaft with two universals, the shaft being horizontal under load. The vehicle has a mileage of 50 per charge at normal speeds. Its wheels carry 30 by 2.5 solid tires.

For next season the other Ward models will carry practically the same battery equipment, the same braking system, and run-



Walker 1,500-pound emergency wagons on top and Walker 1.5-ton delivery at bottom



Two typical types of General Vehicle trucks with gate bodies

ning gear details as used this year, and will sell at practically the same prices.

In general layout Ward vehicles follow the same chassis design using a single motor, mounted transversely under the frame and in rear of the battery. Drive is by silent chain to the countershaft mounted on self-aligning annular ball bearings and thence by side chains. Timken axles are used.

Ward vehicles are listed with a wide range of battery equipment including Ward-Philadelphia, Ward-Willard, Ironclad-Exide, or Edison, the battery equipment in capacity being adapted to the truck work and its zone of operations. With lead equipment 42 cells are used, the number of plates varying according to the models, thus, the 500-pound carries eleven plates, the 1,000-pound, thirteen, the 2,000-pound, seventeen, the 4,000, twenty-three and the 8,000-pound, twenty-nine. The significance of the word Ward in connection with two of the battery options offered is that the company assembles the parts of these respective batteries to meet their own requirements.

The Waverley Co.

Five sizes, 1,000, 2,000, 4,000, 7,000 and 10,000 *pounds.*

Five Waverley models with these capacities are listed for next year, all of these being similar to this year's models with the exception of the 1,000-pound delivery wagon and the 1-ton truck. The 1,000-pound wagon has been completely overhauled and many improvements in design and construction made. The rear system has been made heavier as has differential gearing. The front axle is stronger and the car is generally more rugged than

Specifications of Electric Commercial Trucks and Delivery Wagons for 1914 Show

Name and Model	Chassis Price	Load Capacity in Pounds	Body Style	Width Load Space	Length Load Platform	Overall Length	Wheelbase	TIRES		Make Battery and Number of Cells	Amp-Hr. Capacity
								Front	Rear		
Argo, K-10	$1,750	1,000	Open Ex.	3′6″	7′6″	10′9″	86	34x3	34x3	Exide, 40	138.5
Argo, K-10	1,750	1,000	Stake	5′6″	8′6″	11′9″	86	34x3	34x3	Exide, 40	138.5
Argo, K-20	2,000	2,000	Open Ex.	3′6″	8′4″	11′7½″	96	35x3½	35x3½	Exide, 40	162
Argo, K-20	2,000	2,000	Stake	5′6″	9′6″	12′7½″	96	35x3½	35x3½	Exide, 40	162
Atlantic, 10B	1,750	1,000		3′4″	6′11″	140	102	34–36x3	34–36x3	Optional	
Atlantic, 1-C	2,000	2,000		5′5″	9′4″	151	103	34x3.5	36x4	Ex-Hy 44	
Atlantic, 2-C		4,000		5′5″	10′6″	176	115	34x4	36x3	Ex-Hy 44	
Atlantic, 3-C		7,000		6′	12′	194	135	36x5	40x4	Ex-Hy 44	
Atlantic, 4-C		10,000		6′	13′	208	144	36x6	40x5	Ex-Hy 44	
Bailey, E		300	Open	23″	2′10″	11′9″	106	33x4	33x4	Edison, 60	150
Bailey, E		300	Delivery	3′6″	3′8″	11′9″	106	33x4	33x4	Edison, 60	150
Baker, X	1,900	1,000				10′11″	86	36x3	36x3	Optional	112–150
Baker, O	2,300	2,000				12′7″	102	36x3.5	36x3.5	Optional	140–225
Baker, U	2,800	4,000				**	120	36x4	36x3	Optional	168–300
Baker, CC	3,500	7,000				***	137	36x6	38x4	Optional	224–375
Borland		1,500	Open	3′9″	7′6″	10′10″	93	34x4	34x4	Exide, 40	112
Borland		1,500	Closed	3′9″	7′6″	10′10″	93	34x4	34x4	Exide, 40	112
Buffalo, CCA	2,200	1,500	Optional	4′4″	9′	13′4″	102	36x3½	36x3½	Phila., 44	153
Buffalo, CCA	2,400	2,000	Optional	4′4″	9′	13′4″	102	36x3½	36x3½	Phila., 44	178.5
C.T.	1,645	1,000	Optional	3′6″	6′	11′6″	90	36x2½	36x3	Opt. 42	
C.T.	2,095	2,000	Optional	4′	8′6″	12′9″	100	36x3½	36x4	Opt. 42	
C.T.	2,725	4,000	Optional	4′2″	11′	15′6″	116	36x5	36x3½*	Opt. 42	
C.T.	3,530	7,000	Optional	5′	12′	15′	115	36x3½*	36x4*	Opt. 42	
C.T.	3,935	10,000	Optional	5′6″	15′	18′	132	36x4*	36x5*	Opt. 42	
Detroit, 2-3		2,000			10′	14′9″	108	36x3½	36x4	Edison, 60	225
Detroit, 4-4		4,000			11′	16′	128	36x4	36x3½*	Edison, 60	300
Detroit, 7-2		7,000			14′	19′	144	36x5	36x4*	Edison, 60	375
G.M.C., 1**	1,400	1,000	Optional	Optional	Optional	14′	106	32x2½	32x3½	Opt. 44	
G.M.C., 2**	1,500	2,000	Optional	Optional	Optional	15′	118	32x2½	32x4	Opt. 44	
G.M.C., 3**	1,700	3,000	Optional	Optional	Optional	16′6″	130	32x3	32x5	Opt. 44	
G.M.C., 4**	2,000	4,000	Optional	Optional	Optional	17′10″	138	32x3	36x3*	Opt. 44	
G.M.C., 6**	2,300	6,000	Optional	Optional	Optional	18′	150	32x3½	36x3½*	Opt. 44	
G.M.C., 8**	2,650	8,000	Optional	Optional	Optional	14′4″	156	32x4	36x4*	Opt. 44	
G.M.C., 10**	2,950	10,000	Optional	Optional	Optional	20′10″	166	36x5	36x5*	Opt. 44	
G.M.C., 12**	3,200	12,000	Optional	Optional	Optional	21′	174	36x5	36x6*	Opt. 44	
G.V.	1,370	750	Panel	3′4″	4′10″	9′10″	76	32x2½	32x2½	Lead, 44	102
G.V.	1,700	1,000	Panel	3′5″	6′	10′11″	86¾	36x2½	36x2½	Lead, 44	153
G.V.	2,100	2,000	Optional	4′	8′	12′5″	102	36x3½	36x3½	Lead, 44	204
G.V.	2,600	4,000	Express	4′8″	10′	13′10″	111½	36x4	36x3	Lead, 44	255
G.V.	3,250	7,000	Express	5′	11′6″	15′5¼″	128¾	36x6	36x3½*	Lead, 44	331
G.V.	3,700	10,000	Express	6′	13′7″	17′5″	139	36x7	36x5*	Lead, 44	382
Urban, 10		1,000	Optional	3′6″	6′	10′10¼″	86	36x3	36x3	Exide, 30	165
Urban, 20		2,000	Optional	4′	8′6½″	13′6″	110	36x3½	36x4	Exide, 44	165
Urban, 40		4,000	Optional	5′8″	11′	16′1½″	116	36x4	36x3*	Exide, 44	192.5
Urban, 70		7,000	Optional	6′8″	12′4″	17′5½″	130	36x5	40x4*	Exide, 44	275
Van Auken, A	900	1,000	Closed	3′5″	8′	9′6¾″	80	00x2	00x2	Exide, 16	137.5
Walker, G		1,000	Optional	Optional	Optional	Optional	121	34x3	36x3	Opt. 42	
Walker, F		1,000	Optional	Optional	Optional	Optional	92	34x3	36x3	Opt. 42	
Walker, C		2,000	Optional	Optional	Optional	Optional	Optional	34x3½	40x3½	Opt. 42	
Walker, B		3,000	Optional	Optional	Optional	Optional	Optional	36x4	36x5	Opt. 42	
Walker, D		5,000	Optional	Optional	Optional	Optional	Optional	36x5	36x3½*	Opt. 44	
Walker, E		7,000	Optional	Optional	Optional	Optional	Optional	36x6	36x4*	Opt. 44	
Ward, EO	1,050	625	Optional	Optional	Optional	Optional	81	30x2½	32x3	Opt. 42	127
Ward, EA	1,450	1,250	Optional	Optional	Optional	Optional	90	32x3	34x3½	Opt. 42	153
Ward, EB	1,900	2,500	Optional	Optional	Optional	Optional	108	34x3½	36x5	Opt. 42	204
Ward, EC	2,400	5,000	Optional	Optional	Optional	Optional	60	36x5	38x3½*	Opt. 42	280
Ward, ED	2,950	10,000	Optional	Optional	Optional	Optional	63	38x3½*	40x5*	Opt. 42	357
Waverley, Wagon		1,000	Optional	3′7″	6′1″	11′	90	34x2½	34x2½	Opt. 42	135
Waverley, 1-ton		2,000	Optional	3′8″	3′8″	8′6″	104	34x3½	34x3½	Opt. 42	189
Waverley, 2-ton		4,000	Optional	5′	11′	15′6″	114	36x4	36x3*	Opt. 42	216
Waverley, 3½-ton		7,000	Optional	5′	12′	16′6″	127	36x6	36x4*	Opt. 42	370
Waverley, 5-ton		10,000	Optional	6′6″	13′	17′6″	136	36x7	36x5*	Opt. 42	324

*Dual. **Three lengths, 14′ 5″, 14′ 11″ and 15′ 9″. *** 16′ 2″, 16′ 6″ and 18′ 10″.

this year's model. In the 1-ton truck, a rebuilding process has been carried out and it is now fitted with a pressed steel frame and Timken front and rear axle, similar to those used on the heavier Waverley trucks this year.

A general effort has been made to standardize the different parts in the 1914 Waverleys. Battery compartments have been made especially large to take care of equipments where larger battery capacity is needed due to extra mileage, or where conditions demand a large ampere-hour capacity. S. A. E. wheel dimensions have been adopted as standards throughout. Tire sizes are larger on all models. The speeds have not been raised and in one case there has been an actual reduction, namely, the 1-ton truck whose speed has been reduced from 12 miles per hour this year to 11 next. The battery support and method of carrying, has been improved by leaving an extra amount of air space between the battery trays for circulation. To make the battery still further accessible it is mounted in smaller tray units than formerly. Grease cups have been generally provided on all chassis working parts, and are found on spring bolts, brake shaft bearings, front axle pivots, cross rod, and steering link connections, and on the rear axle at the brake shaft bearings.

Either lead or Edison cells are listed, the former in forty-two cell groups and the latter in sixty-cell units. With lead cells the number of plates ranges according as the vehicle capacity increases, as follows: eleven, fifteen, seventeen, twenty-one and twenty-five. With Edison batteries the cells used are A-4, A-6, A-8, A-10 and A-12.

ing Load Capacity, Price, Battery Equipment, Tires and General Chassis Details

Miles per Charge Full Load at High Speed	MOTOR			Drive to Rear Wheels	Control Location	Forward Speeds	SPRINGS		STEERING		Name and Model
	Make	Type	Location				Front	Rear	Position	Type	
50	Westinghouse	Series	Front rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Argo, K-10
50	Westinghouse	Series	Front rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Argo, K-10
50	Westinghouse	Series	Front rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Argo, K-20
50	Westinghouse	Series	Front rear zx.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Argo, K-20
40–85	Optional	Series	Amidships	Bevel	Left	4	½ Ell	½ Ell	Left	Wheel.	Atlantic, 10B
	Gen. Elec.	Series	Rear	3 chains	Left	4	½ Ell	½ Ell	Left	Wheel	Atlantic, 1-C
	Gen. Elec.	Series	Rear	3 chains	Left	4	½ Ell	½ Ell	Left	Wheel	Atlantic, 2-C
	Gen. Elec.	Series	Rear	3 chains	Left	4	½ Ell	½ Ell	Left	Wheel	Atlantic, 3-C
	Gen. Elec.	Series	Rear	3 chains	Left	4	½ Ell	½ Ell	Left	Wheel	Atlantic, 4-C
60–80	Gen Elec	Series	Front rear ax.	Chain	On wheel	6	½ Ell	Ell	Left	Wheel	Bailey, E
60–80	Gen. Elec.	Series	Front rear ax.	Chain	On wheel	6	½ Ell	Ell	Left	Wheel	Bailey, E
40–50	Gen. Elec.	Series	Front rear ax.	3 chains	Under wheel	5	½ Ell	½ Ell	Left	Wheel	Baker, X
40–50	Gen. Elec.	Series	Front rear ax.	3 chains	Under wheel	5	½ Ell	½ Ell	Left	Wheel	Baker, O
40–50	Gen. Elec.	Series	Front rear ax.	3 chains	Under wheel	5	½ Ell	½ Ell	Left	Wheel	Baker, U
40–50	Gen. Elec.	Series	Front rear ax.	3 chains	Under wheel	5	½ Ell	½ Ell	Left	Wheel	Baker, CC
40	Gen. Elec.	Series	Center chassis	Chain	Left of driver	5	½ Ell	Ell	Left	Optional	Borland
40	Gen. Elec.	Series	Center chassis	Chain	Left of driver	5	½ Ell	Ell	Left	Optional	Borland
45	Gen. Elec.	Series	Part rear ax.	Direct	Left of driver	5	½ Ell	½ Ell	Left	Wheel	Buffalo, CCA
45	Gen. Elec.	Series	Part rear ax.	Direct	Left of driver	5	½ Ell	½ Ell	Left	Wheel	Buffalo, CCA
	Gen. Elec.	Series	Front rear ax.	Worm	Below wheel	3	¾ Ell	½ Ell	Left	Wheel	C.T.
	Gen. Elec.	Series	On rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	C.T.
	Gen. Elec.	Series	On rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	C.T.
	Gen. Elec.	Series	Front & rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	C.T.
	Gen. Elec.	Series	Front & rear ax.	Direct	Below wheel	4	½ Ell	½ Ell	Left	Wheel	C.T.
50	Own	Series	Under front fl'r.	Bevel	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Detroit, 2-3
50	Own	Series	Under front fl'r.	Chain	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Detroit, 4-4
	Own	Series	Under front fl'r.	Chain	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Detroit, 7-2
50	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 1**
45	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 2**
40	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 3**
40	Geh. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 4**
35	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 6**
32	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 8**
27	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 10**
25	Gen. Elec.	Series	Behind rear ax.	Chain	Top of wheel	5	½ Ell	½ Ell	Left	Wheel	G. M. C., 12**
45	Gen. Elec.		Center of frame.	Chain	Left of driver	4	½ Ell	½ Ell	Wheel	Center	G.V.
45	Gen. Elec.		Center of frame.	Chain	Left of driver	4	½ Ell	½ Ell	Wheel	Center	G.V.
45	Gen. Elec.		Center of frame.	Chain	Left of driver	4	½ Ell	½ Ell	Wheel	Center	G.V.
45	Gen. Elec.		Center of frame.	Chain	Left of driver	4	½ Ell	½ Ell	Wheel	Center	G.V.
40	Gen. Elec.		Center of frame.	Chain	Left of driver	4	½ Ell	½ Ell	Wheel	Center	G.V.
45	Gen. Elec.		Center of frame.	Chain	Left of driver	4	½ Ell	½ Ell	Wheel	Center	G.V.
45–50	Gen. Elec.	Ser-Par	Front rear ax.	Chain	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Urban, 10
40–45	Gen. Elec.	Ser-Par	Front rear ax.	Chain	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Urban, 20
40–45	Gen. Elec.	Ser-Par	Front rear ax.	Chain	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Urban, 40
35–40	Gen. Elec.	Ser-Par	Front rear ax.	Chain	Below wheel	4	½ Ell	½ Ell	Left	Wheel	Urban, 70
45	Gen. Elec.	Series	Front rear ax.	Spur	Left of driver	4	½ Ell	½ Ell	Left	Lever	Van Auken, A
	Westinghouse	Series	Part rear ax.	Direct	Left of driver	5	½ Ell	¾ Plat	Left	Wheel	Walker, G
	Westinghouse	Series	Part rear ax.	Direct	Left of driver	5	R. Ell	¾ Plat	Left	Wheel	Walker, F
	Westinghouse	Series	Part rear ax.	Direct	Left of driver	5	R. Ell	¾ Palt	Left	Wheel	Walker, C
	Westinghouse	Series	Part rear ax.	Direct	Left of driver	5	R. Ell	¾ Plat	Left	Wheel	Walker, B
	Westinghouse	Series	Part rear ax.	Direct	Left of driver	6	½ Ell	¾ Plat	Left	Wheel	Walker, D
	Westinghouse	Series	Part rear ax.	Direct	Left of driver	6	½ Ell	¾ Plat	Left	Wheel	Walker, E
50–75	Gen. Elec.	Series	Front rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Ward, EO
45–60	Gen. Elec.	Series	Front rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Ward, EA
40–50	Gen. Elec.	Series	Front rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Ward, EB
35–45	Gen. Elec.	Series	Front rea rax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Ward, EC
30–35	Gen. Elec.	Series	Front rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Ward, ED
50	Own	Series	Front rear ax.	Direct	Left of driver	4	Ell	Ell	Left	Wheel	Waverley, Wagon
45	Optional	Series	Behind rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Waverley, 1-ton
35	Optional	Series	Behind rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Waverley, 2-ton
35	Gen. Elec.	Series	Behind rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Waverley, 3½-ton
30	Gen. Elec.	Series	Behind rear ax.	Chain	Left of driver	4	½ Ell	½ Ell	Left	Wheel	Waverley, 5-ton

**Many chassis of this type but of different price and dimensions are offered.

The Rostrum

Instructions to New Owner Often Inadequate

EDITOR THE AUTOMOBILE:—Many times I have been tempted to write regarding a subject which has been a source of wonder to me for the past 5 years. This desire to unburden myself has been crystallized by the rather sad experiences of a friend.

I have been driving cars for the past 6 years and am familiar with their oftentimes seemingly erratic capers. I have been through the time when a Packard chauffeur was supposed to know nothing about a Panhard and *vice versa*. I have also passed through the time when it was simply a matter of driving any make of car in which you happened to occupy the driver's seat, and have now, like all other motorists, entered the epoch when it is necessary for the driver of an automobile to be a storage battery engineer, a gas engineer and an expert on gauges, solenoid coils, etc. In other words, I can sympathize with the man who has not been gradually led into this state of affairs but who is plumped down into the driver's seat of a $2,250 six-cylinder gasoline-electric vehicle with the vague direction of being sure to keep his clutch pedal down while he is shifting gears.

A short time ago a friend of mine, who had never driven a car, came to me and told me that the car he had ordered was down at the freight yard and requested me to drive to his garage for him. He said he had studied the instruction book and felt that he could drive but did not want to risk the traffic near the freight yard.

I went to the yard and found the car ready to run except for gasoline in the tank and a little more pressure in the tires. The radiator was full. It did not take very long to remedy these two conditions and in a few minutes we were enjoying a spin up the road through a park and eventually to the garage. There I left him to feast his eyes on his new acquisition and to dream of future rides.

One week later he applied his brakes as he started to skid on slippery asphalt. The result was to be expected. When the rear wheel hit the curb it wilted beneath the shock and broke to pieces. The car fell on that side, twisting the frame, etc., etc. The repairs cost $85.

Two or three other accidents have happened since that time and his total cost for repairs has gone far above the $100 mark. This is in less than 2 months. In a short time he will be educated. He will wonder how he ever manged to make the mistakes that he did. Is it his fault?

A man cannot learn to drive from an instruction book. The car is too valuable to risk by leaving a new man to himself. Any amount of damage to the new and complicated devices on a modern motor car can be done in a short time and yet the repair shops are full of cars that could be doing service on the road if the new owner had only been instructed. Is there no way of improving this situation?

NEW YORK CITY. S. E. J.

Repairing Old Automobile Rims

Editor THE AUTOMOBILE:—When the threads on bolts in split automobile rims have become stripped or rusted off, the rims may still be used by drawing the ends together and fastening with a plate and two bolts. The ends are drawn together by the device in the illustration, Fig. 1, showing a turnbuckle linked to a hook at either end. These hooks are thrust in holes which are bored through the rim about 10 inches from the ends and opposite each other. As the turnbuckle is tightened the ends of the rim come together and are thus clamped. The links prevent the hooks from slipping out of the holes as they would if a straight piece of iron was used.

Oakland, Cal. M. H. W.

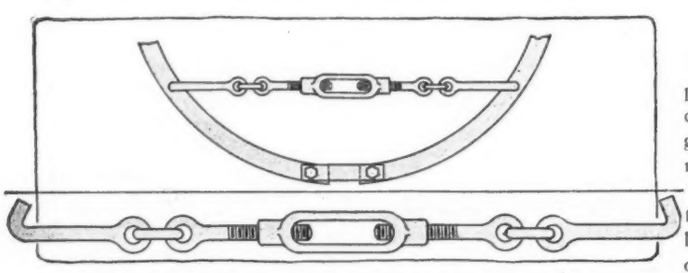


Fig. 1—Method suggested for repairing old split rims

Camshaft Turns at Half Speed

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for October 2, page 617, in which you answered questions regarding silent chain cam drive on the Paige car, we note in the third paragraph of your explanation that you made the following statement:

"There are twice as many teeth in the crankshaft gear as there are in the camshaft gear in order that the reduction will be such that the crankshaft gear makes two revolutions to one of the camshaft gear."

It is the writer's belief that this is evidently an error and I

request that you will kindly advise me accordingly in your next issue.

Buffalo, N. Y. T. C. H.

—This is an error as stated. In order that the camshaft gear will turn half the revolutions made by the crankshaft there will have to be twice as many teeth in the camshaft as in the crankshaft gear.

When two gears are operated through a chain they turn in the same direction.

Dampness Affects Running of Motor

Editor THE AUTOMOBILE:—I have been interested in comments by two of your subscribers concerning the effect on the carbureter of riding on a damp night when the engine appears to be a great deal stronger and a better performer.

My experience, covering 3 years, has been identical with that of the two subscribers referred to.

Is there any way in which a water tank could be fitted and connected with the carbureter in order to produce the vapor and fog effect on a gas such as would give the engine a chance to perform in a similar manner to that on a foggy night? Please illustrate a method of attaching such a tank in one of your early issues.

Mt. Vernon, N. Y. S. M. S.

—A tank can be fitted under the motor bonnet on the forward side of the dash, or if there is no room here on the inside of the dash in the manner shown in Fig. 3. The amount of flow of the water can be regulated by means of a needle valve which is controlled from a point near the steering wheel. The method which could be used in mounting such a device is shown in the illustration. With the needle valve controlled by a slow-pitched screw the increased opening can be regulated so slowly that there will be no danger of getting water into the carbureter if it is turned carefully. With this device, however, there is one danger and that is if the driver forgets to turn off the water when he stops the car the water will keep on dropping down into the carbureter.

It would be a very neat arrangement to have the needle valve inter-connected with the throttle control so that in opening the throttle the needle valve would be opened the required amount. This could be done in some such manner as that shown in Fig. 4, without great labor and by one who would not necessarily have to be skilled in mechanical work. A spring is used to hold the needle valve shut at all times except when the accelerator pedal is depressed. This is inter-connected with the needle valve and opens it sufficiently to feed water when the motor speed is high enough to stand it. It is best not to have the needle valve inter-connected with the hand throttle for the reason that children and others are apt to move the position of the hand throttle which would cause the water to drip into the carbureter. In starting also it is very often necessary to open the hand throttle some distance and it would not be desirable to have water entering the carbureter during the time the driver walked from the control levers to the front of the car to move the starting handle.

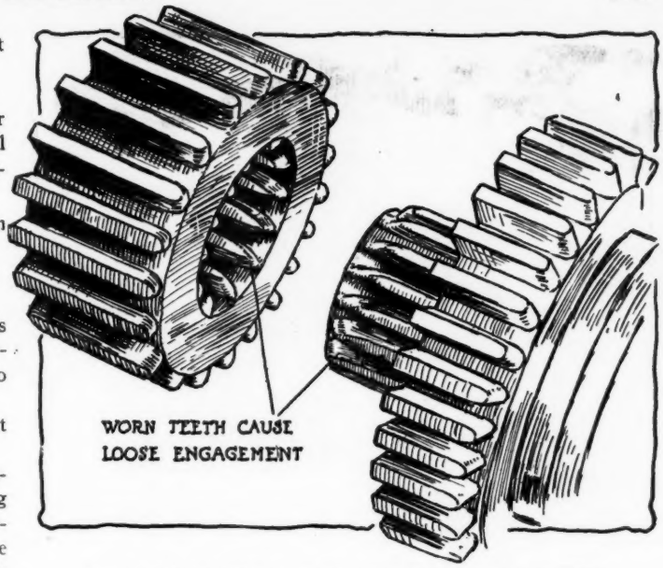


Fig. 2—Worn teeth from clashing of gears in meshing

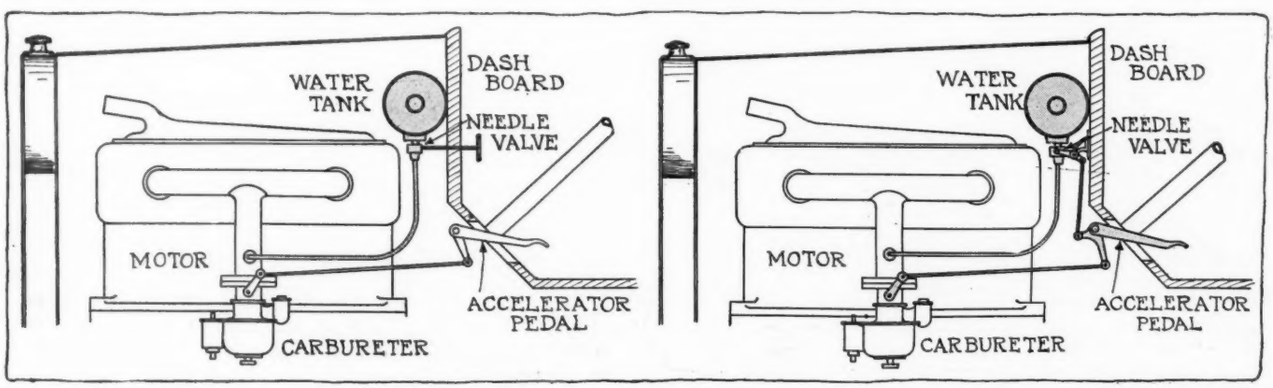
It has been suggested that a sponge or some other absorbent material be placed in the path of the incoming gases to furnish the moisture necessary to produce the effect of fog or dampness. This would be an excellent idea were it not that the intake passage has been designed to be of the proper size for practical gas speeds and any curtailment of this area would choke the charge.

Torque and Radius Rods

Editor THE AUTOMOBILE:—In reading many of the car descriptions which have appeared from time to time in THE AUTOMOBILE I have noticed the terms torque arm or rod and radius rod. Are these terms synonymous? Is a torque rod the same as a radius rod? I would like to know what the meanings of the terms are and also would like to have through The Rostrum an explanation of the duties of this part of the car so that I will have a clear understanding.

New York City. R. T. C.

—The radius and torque rods are separate pieces of mechanism and have independent duties. The torque rods, as the name suggests, are for the purpose of taking up torque strains that would otherwise be exerted on parts of the car upon which this load should not fall. The specific duty of the torque rod in automobile construction is to take up the torque strains on the rear axle housing. As the rear axle revolves it has a tendency to carry with it the rear axle housing. As this part should remain in a fixed position, neglecting for the moment the tendency of the axle to give slightly with the springs, it is necessary to install some device to hold the axle housing in its proper relationship to the axle. It is for this purpose that the torque rod



Figs. 3 and 4—Two methods of installing water mixture tank. Left—ordinary connection. Fig. 4, right—interconnected with accelerator

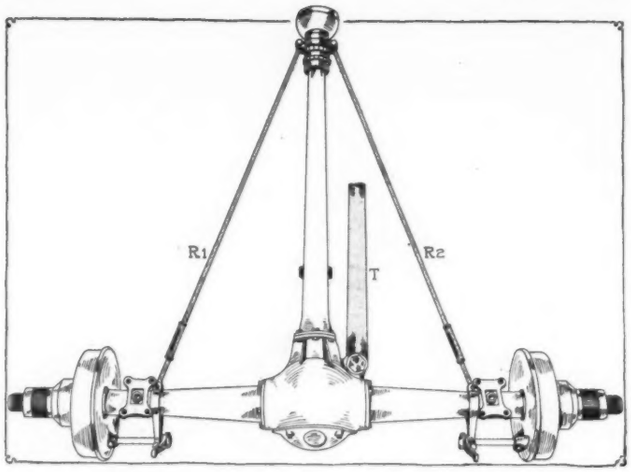


Fig. 5—Diagram, showing torque and radius rods

is used. It is generally mounted in some such manner as T, Fig. 5.

Very often the torque rod will be made up in the form of a tube and instead of being mounted on one side of the driveshaft will inclose it. The construction is then generally referred to by stating that the driveshaft operates within a torque tube.

The purpose of the radius rod is to maintain the proper position of the entire rear axle. Owing to the weight of the car and the driving action of the rear wheels, the rear axle has a tendency to crawl up on the rest of the car. In order to hold the rear axle back where it belongs without putting an additional strain on the springs, the radius rods are used. On some cars there are no radius rods. In this case the drive is taken through the springs. The spring connections are so designed in cases of this kind to support the added strain of the radius rod duties. A common method of mounting radius rods is that shown at R^1 and R^2 in Fig. 5.

Gears Jump Out of Mesh While Running

Editor THE AUTOMOBILE:—I have a Krit roadster 1910 model and the gears disengage themselves, slipping from high back into neutral while running on high speed. Will you please tell me how I can fix it?

Indianapolis, Ind. A. W. PEDIGO.

—On the 1910 Krit car there are two forward speeds and reverse. The high speed is formed by the sliding gear meshing with an internal gear forming a clutch. When the teeth on the high gear become worn they do not hold very well and hence are apt to fly out of mesh in the manner you describe. The gear illustrated in Fig. 2 will be found to have its teeth considerably worn down and the only way of repairing it is by a replacement of this gear. The new part can be secured from the Krit Motor Car Co., Detroit, Mich., and the replacement is comparatively simple work which you can do yourself. The price of the new gear is quoted by the Krit company at $7 for the fifteen and thirty-toothed gear and $8 for the eighteen and twenty-seven-toothed gear. When you remove the old gear count the number of teeth in it and order accordingly. When taking down the gearbox you should inspect the main and layshaft bearings to see if they are worn and you should also go over the teeth of the other gears to see if replacements are necessary there also.

Loose Bearings Caused Motor Knock

Editor THE AUTOMOBILE:—When my Buick model F steadily lost compression, I took it down and found that both piston pins had come loose and had scored both cylinders badly. The pins had been fastened in the pistons by means of large cotter pins, which I found broken in the crankcase.

Following expert advice, I bought new cylinders and rings, had new pins put in the pistons, had holes and bearings fitted, bought new bearings for crank ends of the connecting-rods, and re-assembled the engine. I made a run of about 50 miles, everything working fine, with the exception that the motor knocked considerably, especially when pulling up grade. Retarding spark would not stop the trouble. Suspecting worn and loose crankshaft bearings, I took the engine down again and found them slightly worn. I have ordered new ones.

1—Do you think that the worn bearings were the cause of the knocking?

2—Do you think the cotter pin a safe fastening for the piston pin?

3—What mode of fastening would you advise as a reliable one?

4—I have read and heard about repairing wristpin-scored cylinders without changing the bore of the cylinders. I presume it is done by welding up the scores. Can this be done successfully without distorting the cylinder by the great heat necessary for welding?

Iowa Park, Tex. J. F. W. H.

—1—Provided that you put everything together properly when installing the new parts of your motor the trouble is no doubt due to worn or loose main bearings. If the bearings are worn smooth, giving the looseness without any bad scoring of the bearing material, they may be taken up by removing one or more laminations from the shims between the bearing cap and bearing. This will cause the cap to be drawn more tightly up to the bearing and will do away with the looseness. If there are no shims between the cap and the bearing the same effect as removing the shims may be obtained by filing off some of the metal of the cap making it fit more snugly down over the bearing. Care must be taken that too much metal is not removed from the surface of the cap or the bearing will bind and will become so hot as to cause the bearing metal to flow and the bearing will be destroyed. If the bearings are slightly scored, but not too deeply, they may be scraped to a new fit by painting the crankshaft with red lead, setting it back in its bearings, and, after tightening the caps slightly, giving it a few turns. The crankshaft should then be removed and the high spots on the bearing will be detected by the presence of a coating of red lead. These spots should be scraped off with a bearing-scraping tool, a rounded knife or chisel blade. Do not attempt to file the bearing nor to use a tool which may possibly cut grooves in its surface. Great care has to be taken in scraping off the spots not to remove too much metal from any one point or a hollow will be left that will spoil the fit of the entire bearing.

Perfect Fit Necessary

The operations of putting red lead on the crankshaft and spotting the bearing and then scraping should be kept up repeatedly until a perfect fit is secured. When the fit is good the high spots indicated by the red paint will become very evenly distributed and the red lead will be found to come in contact with practically the entire bearing. If new bearings are put in the scraping process will have to be gone through just the same.

2—The cotter pin is a safe fastening pin on a motor of this size provided that it makes a tight fit in the hole and the ends are properly spread. In this way there is practically no shearing stress of any dangerous amount on the pin and it will hold it to its work very satisfactorily. The ends of the cotter pin must be carefully spread and firmly hammered down so that the pin cannot back out.

3—The cotter pin is safe enough, but if you wish to make a fastening that has a greater factor of safety all you will have to do is to tap the cotter pin hole and put in a setscrew, or a stub bolt. With a stub bolt a lock nut will have to be used to prevent it from backing its way out. It must be remembered that the piston pin bearing is an oscillating one and not a rotating, and therefore no centrifugal strains have to be guarded against.

4—Scored cylinders can be repaired by welding, but it is about twice as expensive as reboring and fitting larger pistons. As a rule, both the welding and reboring have to be done if the

welding work is resorted to as the cylinder is sure to be out of true after it has been exposed to the intense welding heat and if this is done larger pistons will have to be fitted anyway. It would be better in the first place to have the cylinders rebored and larger pistons fitted.

Vulcan Gearshift for Manufacturers

Editor THE AUTOMOBILE:—Will you please answer the following questions in the Rostrum:

1—What is the weight and price of the Julian motor, made by the Julian Motor Co., Syracuse, N. Y.?

2—What company, if any, makes use of this motor in its cars?

3—Who makes the Vulcan electric gearshift?

4—What is the cost of the gearshift and can it be put on an old car at a reasonable price?

Trenton, Ky. R. W. FREY.

—1—The Julian motor is no longer made and as far as can be learned none were ever sold, the company having failed.

2—No makers ever contracted to use the motor in their cars.

3—The Vulcan electric gearshift is made by the Vulcan Motor Devices Co., 628 Land Title Building, Philadelphia, Pa. The company was formerly known as the Standard Gas & Electric Power Co. The officers and directors of the company are Roger W. Griswold, president, Ellis Ames Ballard, Vice-President, Harry E. Kohn, Secretary; J. A. Harris, Jr., Treasurer; Edward Wolf, Francis Shunk Brown, John B. Hamill.

4—The Vulcan electric gearshift is solely a manufacturers' proposition and it requires special adaptation to each particular type of transmission on account of the great number of interferences in the general assembly of a chassis. It is impossible to apply this device on a car now in use at any reasonable figure; it would mean special designing and adaptation which would make the price practically prohibitive.

Calculations for a Cylindrical Tank

Editor THE AUTOMOBILE:—Practically every time I go to my garage I see people using an ordinary foot rule as a gallon measure. In every case they make several idle conjectures as to whether the amount registered on the rule is equivalent to a certain quantity in liquid measure or not. Seeing this apparent lack of accurate knowledge in this respect and realizing the value of having some definite method of determining the amount put into the tank by these new-fangled gallon-per-stroke pumps, I thought I would work out a diagram by means of which anyone could lay out a gallon stick that will read in gallons instead of in some complicated inch measure that does not give any accurate idea as to the number of gallons really in the tank. It must be remembered, however, that this rule applies only to cylindrical tanks.

Referring to the diagram given in Fig. 5 two curves will be seen, one of them is the Gallons Per Inch of Length curve and the other is the Curve of Depth Factors. In the upper left corner of the diagram is a sub-diagram showing the proportions necessary in dividing a tank into ten parts of equal volume. These three diagrams will be explained independently.

First, referring to the Curve of Gallons Per Inch of Length, the purpose of this is to determine the capacity of any cylindrical tank. To operate the curve, read along the bottom scale for the diameter of the tank, then after finding along this scale the diameter of the tank desired, look vertically above it on the Curve of Gallons Per Inch of Length and find the spot on the curve which is directly above the desired diameter. Then reading across horizontally on the scale of Gallons Per Inch of Length and multiplying this sum by the length of the tank in inches its capacity will be found. To make this clear we will take an example:

Assume a tank 12 inches in diameter and 40 inches in length; the problem is to find its capacity in gallons. On the scale reading tank diameter we find 12 and vertically above it we locate a spot on the curve of Gallons Per Inch of Length which corresponds to .49. Multiplying this by the length of the tank in inches, 40 we find the capacity of the tank is 19.6 gallons.

The second curve which we have called the Curve of Depth Factors has directly to do with the laying out of the gallon stick. The method of using it is as follows: To find the distance above the bottom of the stick in inches for any number of gallons, take the scale along the bottom of the chart reading in Parts of Volume and spot the decimal part of the entire volume made by the number of gallons for which you desire to find the point on the stick. Reading above this point on the Curve of Depth Factors you find the decimal part of the total depth of the tank occupied by the liquid when that number of gallons are in the tank. The depth of the tank in inches is then multiplied by this factor and the depth of the liquid in inches will be given. A practical example follows:

Calculating for Stick Measure

Assume the same tank with which we worked above. We found that this tank had a capacity of 19.6 gallons, its depth was 12 inches, neglecting of course the small filler tube or cap above the cylindrical portion. We will find the distance which must be laid off on the stick to measure the depth when there are 3 gallons in the tank. The decimal proportion of the total volume formed by 3 gallons equals 3 divided by 19.6 or .153. Finding the corresponding factor on the Curve of Depth Factors we find this equal to .213. Multiplying this by 12, the diameter of the tank which is always equal to the depth in a cylindrical tank, we have 2.556 or approximately 2 9/16 inches above the bottom of the stick for 3 gallons in a 12 by 40-inch cylindrical tank.

The small diagrams shown in the upper left part of the same illustration can be used if it is desired to divide the tank into 10 parts of equal volume. The Depth Factors are shown in figures at the right side of the equations given in the diagram. The only capacity tank with which this small diagram can be used to divide a stick into gallons would be the 10-gallon tank.

In laying out a tank stick a great amount of labor will be saved if it is remembered that the measurements on the stick about the center of its depth will be symmetrical, that is on a 12-inch tank the notches cut above the 6-inch mark will be the same distance from the 6-inch mark as the corresponding notches cut below the 6-inch mark. This will cut the work of laying out the stick in half.

New York City. MILTON SAYLES.

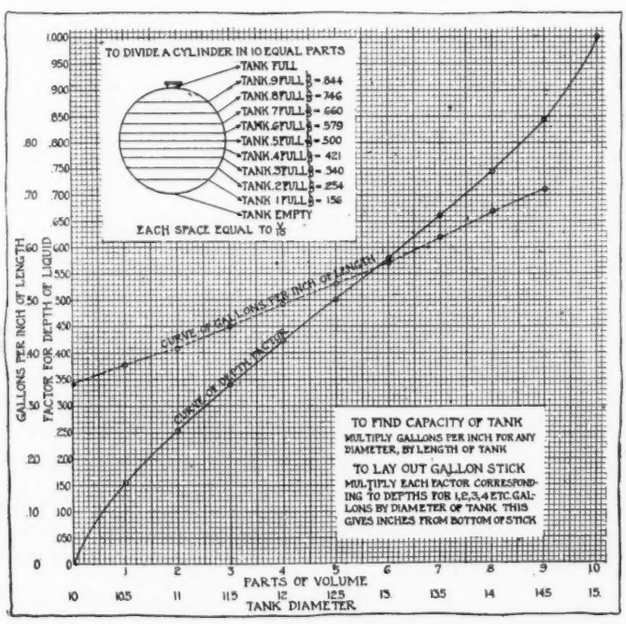

TO DIVIDE A CYLINDER IN 10 EQUAL PARTS
TANK FULL
TANK .9 FULL 8/8 = .844
TANK .8 FULL 8/8 = .746
TANK .7 FULL 8/8 = .660
TANK .6 FULL 8/8 = .579
TANK .5 FULL 8/8 = .500
TANK .4 FULL 8/8 = .421
TANK .3 FULL 8/8 = .340
TANK .2 FULL 8/8 = .254
TANK 1 FULL 8/8 = .156
TANK EMPTY
EACH SPACE EQUAL TO 1/10
GALLONS PER INCH OF LENGTH
FACTOR FOR DEPTH OF LIQUID
CURVE OF GALLONS PER INCH OF LENGTH
CURVE OF DEPTH FACTOR
TO FIND CAPACITY OF TANK
MULTIPLY GALLONS PER INCH FOR ANY DIAMETER, BY LENGTH OF TANK
TO LAY OUT GALLON STICK
MULTIPLY EACH FACTOR CORRESPONDING TO DEPTHS FOR 1,2,3,4 ETC. GALLONS BY DIAMETER OF TANK. THIS GIVES INCHES FROM BOTTOM OF STICK
PARTS OF VOLUME
TANK DIAMETER

Fig. 5—Curves to lay out a stick to measure tank contents

The Engineering Digest

Data from the German Aviation Motor Contest of Interest to Builders of Modern Automobile Motors

(Continued from last week, page 727)

Extracts from a report by Professor F. Bendemann on the progress in motor construction shown by German builders and on the shortcomings still remaining. Owing to recent developments in aviation—mainly the upside-down flights by Pégoud—which result in the requirement that motors for aviation shall be capable of being operated in any position, the German aviation motors, among which those with revolving cylinders are only weakly represented, but whose makers, on the other hand, have studied assiduously to produce fuel economy and reliability as well as minimum weight for the motor plant as a whole, including the fuel and oil supply for very long flights, are now apparently of greater technical importance to show what may be done for the refinement of high-class automobile motors than in the smaller field for which they were primarily intended. Their resemblance to racing-car motors is at all events striking and suggestive, while the improvements adopted by their builders are much in line with those found in other modern high-speed motors. The ostensible exception that the bore is large in proportion to the stroke is only the result of the high power required. In absolute figures the stroke is as long as in automobile motors. How the difficulties in cooling motors of this description are overcome was related in part in the previous instalment, the means employed being especially interesting because they would not involve a loss of efficiency if applied to the motor sizes suitable for motor vehicles or under the throttle.

Peculiarities of the Oiling Systems Continued

THE lubricating properties diminish with rising temperatures. For this reason a constant replacement of the oil in the most heavily taxed bearings [those with highest loads and slowest movement] and a sufficient cooling of the oil in a capacious oil well are required, preferably with cooling-pipes utilized for the heating of the carbureter, as in the Benz motor, the winner of the Kaiser Prize.

At high temperatures castor oil retains its viscosity and lubricating properties considerably better than good mineral oil, as shown by the tests summarized in the appended table:

	Minimum Heat Units per kilogram	Viscosity in Engler Degrees at temperatures centigrade 60 deg.	100 deg.	120 deg.
Mineral oil, No. 1	10,116	3.37	1.65	1.41
Mineral oil, No. 2	10,080	2.75	1.46	1.20
Castor oil	8,298	10.72	2.72	1.95

Castor oil is therefore still indispensable for air-cooled motors, but for the water-cooled motors at the contest one or the other of the two mineral oils referred to in the table was always sufficient. [Apparently none of the contestants risked the use of mineral oil mixed with graphite; perhaps because it was desirable to obtain cooling effects incidentally with the lubrication.—Ed.]

The dip-and-splash system for getting the oil to the bearings is simpler than any other, but the motors in which it is used generally smoke and, as shown in diagram, Fig. 7, the oil consumption is much greater than by force-feed. In this diagram, the lowest consumption represented by the three dots to the left is that obtained from a pure circulating system without addition of fresh oil, but it will be noticed that the large middle group, representing the consumption by a combined circulation and fresh-oil system, also represents the motors with the highest power efficiency unit.

A circulation system is best realized by means of complete ring oilers on the crank-arms and a tube connection between the two ends of each connecting-rod, the oil being first forced to the stationary bearings of the crankshaft. By the construction shown in Fig. 5 (last week) the ring oiler is worked out only in part, one portion being replaced by a recess in the crankarm.

With the hollow-crankshaft construction shown in Fig. 8, the oil is first forced to the fixed bearings and the interior of the shaft and thence by centrifugal action to the connecting-rod knuckle. On the way from the fixed bearing to the interior of the shaft it must overcome centrifugality, and this necessitates very clean bearings and occasionally a high oil pressure. Intermittently and positively acting piston pumps are in that case more reliable than gear pumps. By a force-feed extending to the piston pin very little oil is wasted and a supply sufficing for several hours can be contained in an oil well of very moderate size involving but a slight enlargement of the crankcase. If the space here provided is insufficient the supply must be supplemented by means of a fresh-oil pump drawing upon an outside tank, but with regard to this arrangement it has been found well worth remembering that in cold weather the oil in external ducts is thickened so much that the ordinary pumping action may fail, with the result that connecting-rod bushings are melted out. The fresh-oil pump may either mix its feed with that of the circulation pump or feed a separate circuit. The latter arrangement offers however scarcely any real advantage, as the relatively small amount of fresh oil required for maintaining the lubricating properties of the total would not in itself be sufficient if the circulation oil feed failed. The different systems mentioned were represented at the contest by the constructions indicated in Figs. 9, 10 and 11, A, B and C. The location of the pump or pumps in a well which has its greatest depth at the middle of the crankcase seems preferable to safeguard the feed at either forward or backward or lateral inclination of the motor and in conjunction with a possible minimum oil supply.

Circulation oil becomes mixed with metallic dust and residues of combustion. Small particles do no harm and larger ones can be kept from the pump by means of brass screens. These

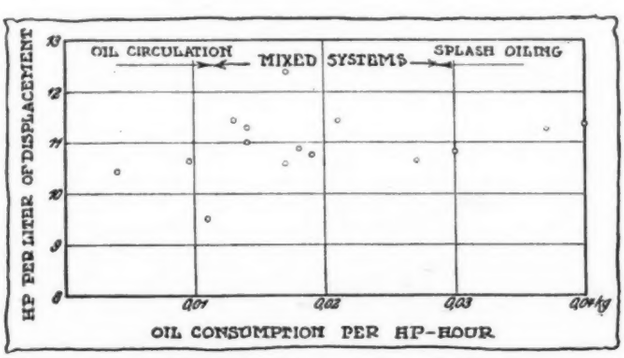


Fig. 7—The lubrication in the 15 most successful water-cooled German aviation motors

screens were not always accessible in the motors at the contest. The metal in bushings receives a peculiar greyish coating from the carbon dust which becomes diffused in circulation oil after some use, but this does no harm, in fact it improves the bearings. **Great demands are made upon the oil pumps at low temperatures, and parts involving a separate resistance to operation, such as valves opened against spring pressure, are found to get out of order easily.**

Ignition Now Very Reliable

During the whole contest no motor was stopped by the failure of spark plugs, and this remarkable result can probably be ascribed to the system of securing the insulating material by a double metallic jacket which keeps the insulation cool and permanently gastight. The latter point is important, because at the slightest leak oil and soot are forced into the plug together with the combustion gas.

About half of the motors had ignition from 2 plugs for each cylinder, by which provision a small but perfectly plain improvement in efficiency is obtained, less heat being absorbed by the cooling-water. The advancement of the spark can then also be reduced. The much used starting dynamos were reliable only in connection with a timing device in the distributer of the magneto. Without this safeguard backfires occurred which rendered the starting precarious. The operation of the starting apparatus was especially facilitated by double-jet carbureters, as these make it possible by a slight turn of the airscrew [respectively the starting crank of a vehicle] to charge the motor in advance with a mixture rich in gasoline. Magnetos of the inclosed kind demonstrated in several instances their immunity from the usual effects of water splash. The magneto must not be exposed too much to air currents, as then water is precipitated upon it from the atmospheres, which even with the waterproof construction becomes dangerous in the long run. It was shown to be the best plan to mount the magneto behind the cylinders, if the accessibility of the distributer was also considered.

Welded Water Jackets and Steel Cylinders

Cylinders cast in one with their jackets always show unnecessary thickness in all places where machining is impracticable and are not necessarily cheaper to produce than lighter forms, as the wasters among the castings are numerous. Cylinders cast with a hood open at the bottom, Fig. 12, to serve as jacket for valve housings, admit at least of machining the whole combustion chamber and stroke portion inside and outside, and only the valve housing and its jacketing remain too thick. To avoid also this feature a naked cylinder casting was in one instance, Fig. 13, fitted with an autogenously welded-on jacket. The Austrian Daimler motor has a similar jacket worked up and applied in one piece by electroplating process. Still considerably lighter are the cylinders of the Daimler six-cylinder motor which took the second prize and which, but for certain regulations binding upon the judges, would have taken the first. In this all casting is discarded and the cylinders proper are turned from the solid bar while the jackets and conduits are welded on, Fig. 14. The very thin walls admit of a much improved cooling action, previously referred to.

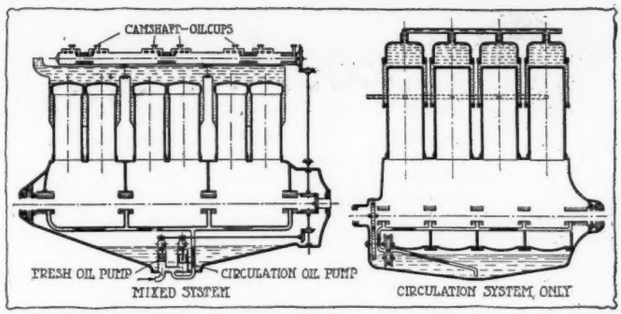


Fig. 9—Fresh-oil pump working into general oil circuit. Fig. 10—Most economical method

Arrangements of the Valves

All motors but one [the total number entered was 68 but the number was narrowed down in course of the trials and by withdrawals] had the valves in the cylinder heads and the valve seats ground upon the material of the cylinders themselves. To get room for large valves without an unfavorable shape of the combustion chambers, the valves were in many instances placed obliquely, as in Fig. 14, or it was rendered possible to introduce the valvestems obliquely into their guides by lining the latter

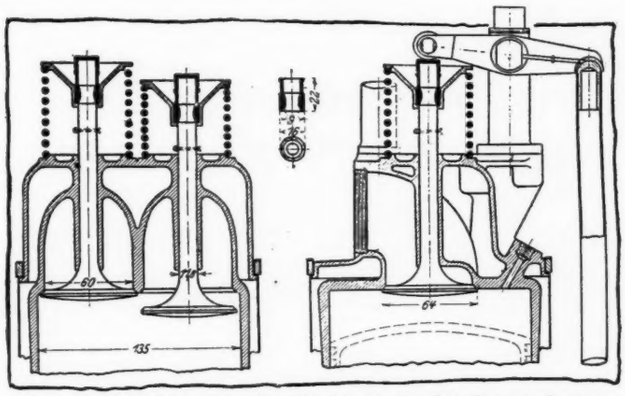


Fig. 12—Cylinders cast with hood for valve-housings and copper jacket drawn down over it. Valve spring action equalized by spheroid joint on valve stem

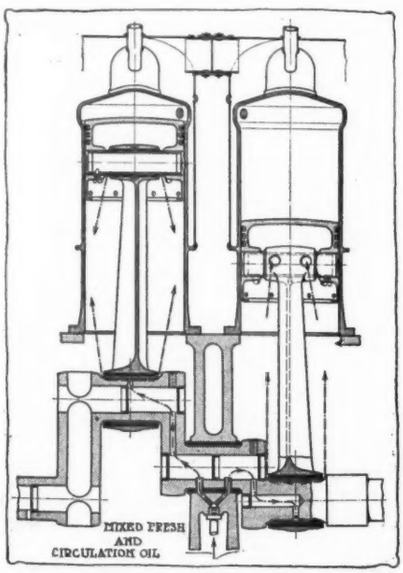


Fig. 8—Example of force-feed oil circulation system with fresh-oil additions

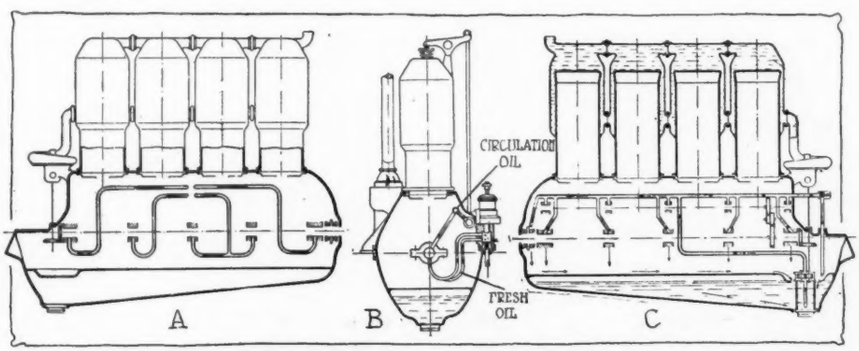


Fig. 11, A, B and C—Showing plans of a lubricating system by which fresh oil and circulation oil are sent through separate circuits

with removable bushings, or by turning the valvestems down stepwise, as in Fig. 13. Hanging valves are exacting with regard to cooling, guidance and operation. The slightest misalignment between the mushroom and the stem, a worn guide, a rocker arm striking obliquely, cause a bending strain at the root of the stem which soon fatigues the material, with the added influence of the high heat, the exhaust valves being permanently red-hot during operation of the motor. Then the mushroom breaks off, falls upon the piston head, breaks it (as happened in one case during the tests) and continues its destructive work down in the crankchamber.

To avoid side pressures from the valve springs it is noticed that, as in Fig. 12, the spring pull is transmitted to the valve stem through a self-aligning joint effected by means of a bushing with a curved inner surface.

Lengthwise Expansion of the Crankshaft

As the temperature rises during operation the crankshaft expands, and for this expansion ample play must be provided in all bearings except one, which in the case of aviation motors must be the endthrust bearing of the airscrew.

[Concluding remarks by the authors refer to the provisions for the proper mounting of the airscrew and to the fact that the properties of radiators were excluded from consideration by the judges in this contest but, on the other hand, will be considered in the next contest which is to be held in January, 1915.]—From *Zeitschrift des Vereines Deutscher Ingenieure*, September 6.

Why Worm Drive for Heavy Trucks?

Builder Who Employs Bevel Gears Ordinarily Thinks Soft Start Urgently Needed for Heavyweights—Worm Gives It

IN reply to an adverse opinion, the Blum-Latil firm of Paris gives its reasons for adopting worm-drive for its heavy four-wheel-drive commercial vehicles. It is noticed that the reasons are brief and that no claims are made with regard to the long life, without repairs or deterioration, which is now being mentioned elsewhere as the most indisputable advantage of the worm and the worm-wheel and which is based upon the area of the wearing-surfaces and the avoidance of shock and vibrations in the engagement of the teeth. Mr. Blum writes in substance as follows:

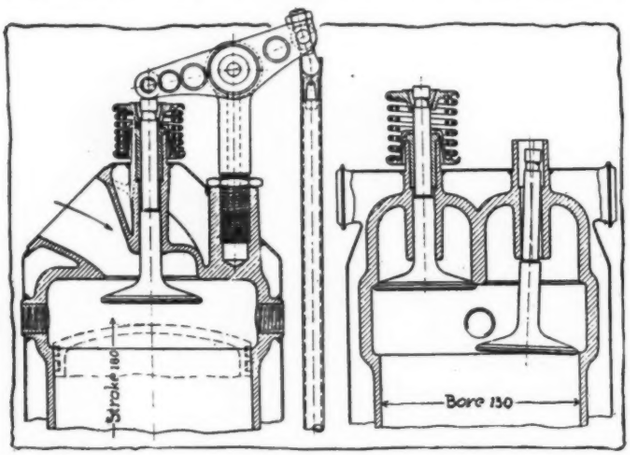


Fig. 13—Cylinder machined inside and outside; copper jacket welded on. Valve stems turned stepwise to help introduction

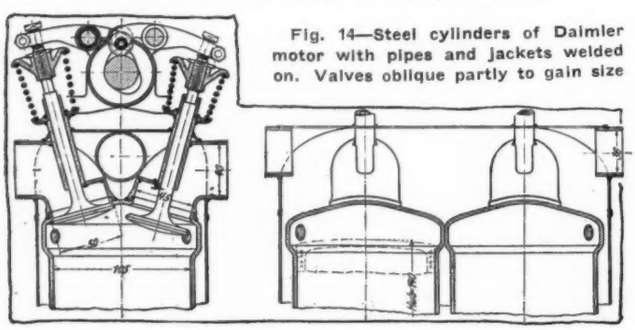


Fig. 14—Steel cylinders of Daimler motor with pipes and jackets welded on. Valves oblique partly to gain size

The Teddington tests demonstrated a maximum efficiency of 96 per cent. for the worm. If the bevel gear can attain 97 per cent., these are the figures to be compared. It is not fair to compare the average of one type of transmission with the maximum of another.

Taking into account that the worm admits a greater gear reduction than the bevel gear and that this feature usually renders it possible to dispense with one reducing-gear in the total transmission mechanism, it is seen that, so far as efficiency is concerned, the two types are equal. As regards the maintenance, it is certainly necessary to keep the worm well lubricated. The casings should consequently be designed in accordance with this need, with the worm below the wheel.

If the worm is the more silent type, that can be conceded to be a minor advantage in the case of trucks, but the worm also admits of much more gentle and progressive starts, and this is a considerable advantage for heavy vehicles. It is for this reason that we employ the worm for our heavy trucks and tractors where the ease of starting is of great importance while we continue to use bevel gears for our lighter trucks.

Nearly all the motor buses in London are now provided with worm-drive and nobody complains of it, although the first among them have by this time made more than 150,000 kilometers. We are convinced that more will follow us in adopting the worm. The easy starting results in a great saving in tires. The only drawback of the worm-drive is its high first cost, but a truck is bought only once and it is used every day.—From *Le Poids Lourd*, September 19.

Reaction from Slump in Rubber Market

Low Prices Force Planters to Seek Government Aid in Production and Marketing of African Gums

Rubber prices are written up or down in London. When they went down last year it was largely in response to information which made it certain that a good grade of plantation rubber will soon be as staple a crop throughout the tropics and subtropics as rice, coffee and cotton. The plantations in India and in German Africa, especially Kamerun, promised a crop for 1916 four times greater than the total production of Brazil and Ecuador for 1910. Moreover, famous chemists threatened to throw synthetic gum into the competition sooner or later if prices were kept up.

The slump is now reacting against the plantation financiers whose rosy reports were the principal cause of it. Kamerun sends out a cry for help dated from Hamburg, this city being second in the rubber market, rather than New York, only for lack of American vessels in world's trade. German colonists cannot build up plantations on the new basis. The Industrial Committee of the German Colonial Society is calling for first aid to the wounded from the colonial administration of the German empire, the petition asking for the following enactments: (1) Provision suspension of export duty on rubber in Kamerun, (2) specially reduced railway and steamship rates for rubber and materials used in its production, (3) inducements to make desirable native workmen settle near the plantations, (4) more automobile roads and railways in the rubber districts. In addition it has been decided to work for the introduction of waterproof rubberized clothing for the German army and the personnel of the postal and railway departments.—From *Dinglers Polytechnisches Journal*, Oct. 4.

Specialties in the Storage Battery Field

Bolt Type of Connector Shows Development

FOR 1914 the products of the battery manufacturers show in most cases scarcely any alteration over this year's designs. A few minor improvements are noticeable, such as new types of bolted connectors. Further standardization in plate and cell sizes is also evident. Practically all makers now include three thicknesses of plate in their lines. Special points which mark the different types are given below.

Philadelphia—The specialty of the Philadelphia batteries is the use of a diamond construction for the grids by which it is claimed a much lighter grid is obtainable for the same strength and with as large an area of contact with the active material.

Fig. 2, A, shows the diagonal arrangement of the grids in this type of plate. The vertical walls are solid through the thickness of the plate. The slanting grids, of roughly triangular section, are arranged so that the points of intersection on one side are not opposite those of the other side. In other words, the diamonds overlap. The difficulties of casting these grids in comparison with the ordinary parallel grids will be at once apparent. A set of tongues or cores are used in the process. These occupy a position between the two faces of the mold and correspond to the interior spaces between the two sides of the grids and the vertical walls. After casting, these cores are withdrawn from the base of the plate and a new lower edge burned on.

As showing specifically the advantages brought about by the thin plate construction of increasing capacity and mileage of a given vehicle the following figures are of interest: A 4 1-4 inch jar containing plates of the thick type used 7 years ago had a capacity of 140 ampere hours and weighed 34 pounds. The latest design of Philadelphia battery with thin plate elements has a capacity for the same size jar of 204 ampere hours and weighs 1 1-2 pounds lighter. In the early type eleven plates were used to the size of cell mentioned and in the thin plate type thirteen. Thus 45 per cent. more mileage can be obtained from the vehicle with the modern battery.

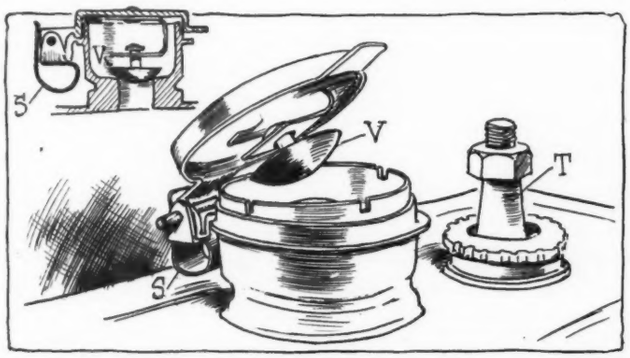


Fig. 1—Combined filler cap and valve for the escape of gas on the Edison battery

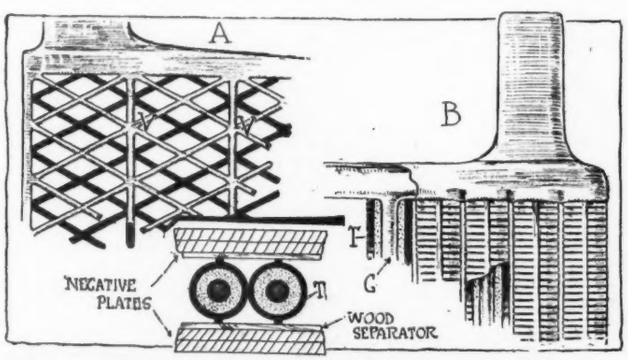


Fig. 2—Diamond grid of the Philadelphia battery and construction of plate in the Ironclad Exide battery

The standard sizes of plate are 8 5-8 inches long by 5 3-4 inches wide, but there is also listed a narrower plate of the same length specially adapted for pleasure vehicles. This measures 4 13-16 inches wide and fits into a jar with an outside width of 5 5-16 inches. The narrow measure of this plate allows the assembly of a large number of cells in a small battery space. The bridge is either 1 1-4 or 1 1-2 inches high for these cells, which are made up in 5-plate to 15-plate sizes.

Edison—The Edison battery is radically different from all other types. Its principle depends on the chemical action of iron and nickel in an alkaline solution, whereas almost all other practical forms of storage battery make use of lead in diluted sulphuric acid.

Instead of lead grids being used for the plates, nickel-plated steel stampings containing pockets filled with the chemicals iron oxide and nickel hydrate are used. Mechanically the only difference between the positive and negative plates is that of the shape of these pockets. In the negative plate iron oxide is packed into a number of rectangular containers made of thin perforated nickel-plated steel, and these are supported in three horizontal rows in the grid. In the positive plate two rows of small tubes, also formed out of thin nickel-plated steel, act as containers for the nickel hydrate, which is tightly packed into the tubes in thin layers alternated with layers of metallic nickel in flakes.

These nickel flakes are a means of obtaining a large electrical contact with the hydrate, the area presented by the interior surface of the tube being thus materially augmented.

The plates are assembled alternately positive and negative in the usual manner, being kept apart by hard rubber separators. The jar is made from heavily nickel-plated sheet steel welded both at the bottom and at the top. To impart strength to the sides of the cell horizontal corrugations are stamped in the metal.

The cells are supplied in various sizes and capacities, but there is only one width and thickness of plate and only two heights. Cells made up of the longer plates are designated A and the shorter, B. The heights of the jars are approximately 8 inches and 13 inches for the two types. The overall width of the cells in all types is about 5 1-4 inches.

The electrolyte for an Edison cell is a potash solution and when refilling is necessary distilled water is added through a filler cap at the top. This filler is an ingenious constructional feature, Fig. 1. A valve V is combined with it to allow the escape of gas, and at the same time prevent the entry of impurities. This valve V is heavy enough to rest on its seat with the necessary pressure, no springs being used. The cap is of the snap type, remaining either open or closed by the small spring S at the hinge.

T in the same illustration shows one of the two terminals which pass through rubber insulators in the top of the cell,

and are situated one on each side of the combined filler and gas valve.

Exide—The Electric Storage Battery Co. makes four types of battery suitable for electric vehicle propulsion, the Exide, Hycap-Exide, Thin Exide and Ironclad-Exide. The first three of these represent the thick, medium and thin plate types that are now general with most battery concerns.

The Ironclad type of plate is radically different from the accepted staggered grid and is intended to prevent the waste of active material by confining it in such a way that although the electrolyte is given all the necessary access yet it is almost impossible to shake out the loose material. This is accomplished, as shown at B, Fig 2, by packing the active material in hard rubber tubes T surrounding the bars of the grid and allowing entry of the acid through numerous slits cut horizontally across the tubes.

In manufacture the grids are first cast with plain cylindrical bars G but without a lower edge connecting their ends. The prepared rubber tubes are then slipped over the grids and the conecntric space between them packed with active material in the form of paste. A lead bar is then burned to the lower ends of the grids, completing the frame. Both upper and lower edges of the grid are encased in hard rubber sheaths so that the only surface directly exposed is of insulating material and preventing the possibility of short-circuiting.

A slight rib formed in the rubber of the tubes and passing down the entire length at both sides serves to strengthen the tubes which otherwise might display weakness through the cutting of the slots, and at the same time acts as a distancer between the positive and negative plates.

It should be particularly noted that the negative plate is of the ordinary staggered grid type and has no rubber protection. In assembling an Ironclad cell a thin wood separator is placed on each side of the negative plates and this in conjunction with the ribs on the rubber tubes on the positive plates forms all the separation necessary. Another point worthy of notice is that, although the positive plate is much thicker than the older grid form, yet the fact that the entire surface is insulating does away with the need for ribs on the wood separator, so that exactly the same number of plates of the Ironclad type can be got into a jar as with the ordinary lead grids.

All types of Exide battery are available in the standard sizes of plates, 8 5-8 inches long by 5 3-4 inches wide. There is also a narrow size of the same height, 4 13-16 inches wide.

U. S. L.—The batteries of the United States Lighting and Heating Co. are made with plates of three different thicknesses to suit various capacity and mileage requirements. These are referred to as the Types WB, WBH and WBT respectively. For vehicle use both on pleasure electrics and commercials the standard size of plate is 8 5-8 inches by 5 3-4 inches. They are made up in all sizes of cells from 5-plate to 31-plate, including all the intermediate odd numbers.

Two heights of bridge are supplied, 1 3-4 and 2 3-4 inches. This applies to the WB and WBH types. In the case of the WBT cell only the 2 3-4 bridge is furnished. This latter bridge, as it forms a large mud space underneath the plates for the accumulation of sediment without danger of short circuit or need for frequent washing out, is always advisable if the height of the battery space on the vehicle permits it.

The total heights of the cell jars with the two depths of mud space are 12 3-8 inches and 13 3-8 inches. A little must be added to this to allow for the connections between the cells.

An interesting type of bolt connector manufactured by the U. S. L. Co. is shown in Fig. 4. It will be understood that the great difficulty met by designers of the bolt type of connector is that of preventing corrosion due to the creeping of the acid along the screwed stem of the bolt. In the particular design illustrated both ends of the bolt are protected by a lead cap C which is screwed up tightly on the bolt itself and against the face of the plate plug. Before doing so the inside is filled with vaseline. A small hole drilled in the cap allows the escape of surplus vaseline, while fitting. Electrically, the joint is made good by the use of a square tapered spigot S and faucet on the inside faces of the lugs.

This form of connector permits of quick battery assembling and is used a great deal on commercial trucks. Pillar and T and L lead burned strap connectors are also fitted. One advantage that these possess over the bolt type is that slightly less head room is required, the bolt connector requiring about 1 inch above the top of the jar and the strap type 1-2 inch.

Minor details of construction are the provision of soft rubber tops to the bridges to prevent jarring of the plates, and a hard rubber peg which is passed after assembly through holes drilled in the lugs of the plates to keep the wood and rubber separators in place.

Willard—Some interesting features of the LBA batteries, manufactured by the Willard Storage Battery Co., are illustrated in Fig. 3. At A is shown a rectangular rubber gasket which has been designed as a variant to sealing the tops of cells with molten compound. It is made from the best floating stock rubber so as not to deteriorate with acid. The sides are tapered to insure a perfectly tight joint when forced into the space between the cell wall and the specially flanged hard rubber cover as shown at B.

The same illustration shows a condensing type of vent plug G which is screwed into the cover. This is blown molded in hard rubber and the passage for the escaping gas is such that any bubbles forming are broken. Globules of acid suspended in the gas alight on the inside surface of the plug.

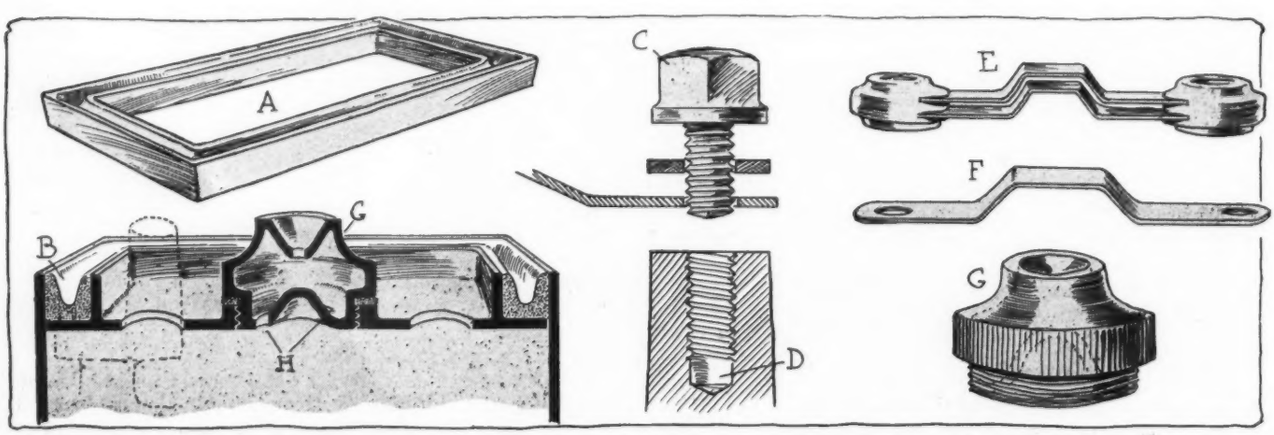


Fig. 3—Details in the LBA battery. A, rubber sealing gasket. C, lead-headed connecting bolt. E and F, copper connectors. G, condensing vent plug

which is so inclined that on collecting, the fluid flows back into the cell.

Burned cell connectors or those of the bolted type are optional on LBA batteries. Two copper connecting straps are shown at E and F. These are plated with lead, making them acid-proof. Since the conductivity of copper greatly exceeds that of lead it is possible to allow the same freedom to the passage of the current with a much lighter connector. A greater degree of flexibility is obtained at the same time. In the double strip type, E, the ends of the copper connectors are cast into solid lead eyes for direct attachment to the terminal pillars of the cells.

Where a bolt is used for the connector attachment as at C, the screwed hole in the pillar D is filled with vaseline before insertion so as to protect the brass stem. The bolt is embedded in the head, which is cast in lead.

Two sizes of plate are listed as standard and three thicknesses. The length of the plate is uniform in all types, 8 5-8 inches, fitting into cells of two heights 13 and 14 1-2 inches. The higher cell is that provided with a 3 1-4-inch mud space. The three types of plate are called heavy, medium and thin. Each is supplied in two widths, 4 13-16 inches and 5 3-4 inches, the corresponding external sizes of the jar accommodating them being 5 5-8 and 6 1-8 inches.

Gould—The batteries by the Gould Co. are made in five types, including thin, medium and thick plates, in two-plate sizes, 8 5-8-inch by 5 5-8-inch, and the same height by 4 13-16 inches wide.

Staggered grids are used for the plates, and in other particulars constructionally the Gould battery is in line with the best accepted practice. A particular feature, however, in which this concern claims to show advantages over many other types is in the composition of the paste in the positive plates. This is so composed that a much harder active material is obtained, with the great advantage that when in use only the outer surface is softened and more life is given to the plate than if the material were soft right through.

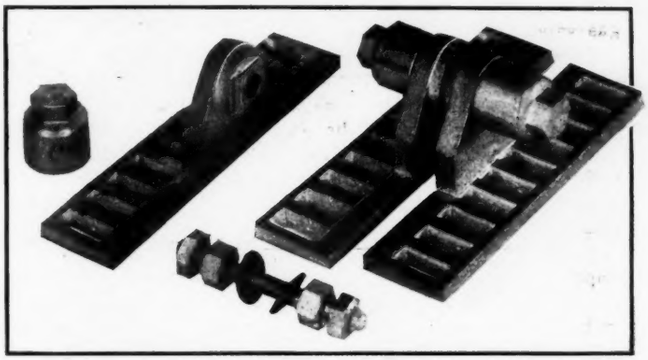


Fig. 4—Bolt type of cell connector on U. S. L. battery

In the negative plate, also, much attention has been given to the composition of the paste, so that the shrinkage which takes place in the life of the plate is offset by the swelling of another element in the paste. By this means a good electrical contact is maintained at all times, a feature which has much to do with the cell's efficiency.

Baltimore—The Baltimore Electric Storage Battery Co., a new concern located in Baltimore, is marketing two lines of vehicle batteries with four thicknesses of positive plates and three thicknesses of negative plates. The two sizes of plate referred to are 4 13-16 inches and 5 3-4 inches wide by a uniform length of 8 3-4 inches.

The positive plate thicknesses are 7-32, 6-32, 11-64 and 9-64 inch. The thinnest negative plate is only 1-8 inch thick.

A heavy plate cell consisting of four 7-32-inch positives and five 6-32-inch negatives in a 3 1-2-inch jar gives 28 amperes for 4 hours, or 112 ampere hours. In comparison, a thin plate cell, using 9-64-inch positives and 1-8-inch negatives in a 3 5-16-inch jar gives 25.5 amperes for 6 hours, or a capacity of 153 ampere hours. In the latter case thirteen plates are used.

Battery Action in Charge and Discharge

(*Continued from page 747.*)

PLATES DURING DISCHARGE IS, DURING CHARGE, DRIVEN FROM THE PLATES BY THE CHARGING CURRENT AND RESTORED TO THE ELECTROLYTE. THIS IS THE WHOLE OBJECT OF CHARGING.

It has been said that every man has a different method of charging a storage battery, but in fact all methods are essentially the same in principle; that is, to pass direct current through the cells in the right direction. In the use of this current there are only two points to be considered—rate in amperes and time.

The rate in amperes is limited by the state of discharge. When a battery is fully discharged, at which time the plates contain the greatest amount of sulphate, it can utilize current at the highest rate. As the charge progresses and the amount of sulphate in the plates decreases they can no longer utilize current at the same rate and the current should be reduced. The time at which to reduce the rate is when the cells begin to give off gas.

The gassing of a cell is a feature of charging which has been very little regarded but is of great importance. **Gassing shows at any time whether or not the charging rate is too high.**

Current passing through an electrolyte will always do something. It will always do the easiest thing first. When current is passed through a discharged cell the easiest thing is to decompose sulphate. As there is a comparatively large amount of sulphate in a fully discharged cell a high rate of current can be used, but as the amount of sulphate decreases a point will be reached at which there will not be sufficient sulphate remaining in the plates to utilize all the current passing through. **The excess current will then begin to do the next easiest thing, which is to decompose the water of the electrolyte, producing gas and, therefore, when the cells begin to gas freely it indicates that current is being passed through the cells at too high a rate and the rate should be lowered sufficiently to stop the gassing.** As the charge is continued at the lowered rate the remaining sulphate will continue to decrease in amount until there is not sufficient left to utilize this rate of current and the cells will again begin to gas. The rate should be lowered each time the gassing begins.

When the cells begin to gas freely at a very low rate it indicates that there is no sulphate remaining, so that even this very low rate of current cannot be utilized, and the charge is completed.

The sulphating which takes place during an ordinary discharge is entirely normal. If, however, charging is neglected, the sulphate increases and becomes hard and the plates lose their porosity and are not easily charged; this is the abnormal condition usually referred to as "sulphated."

In ordinary charging there is not sufficient time to continue the charge until absolutely all the sulphate is removed. To prevent any possibility of the small remaining amount of sulphate increasing and becoming hard a weekly overcharge is given.

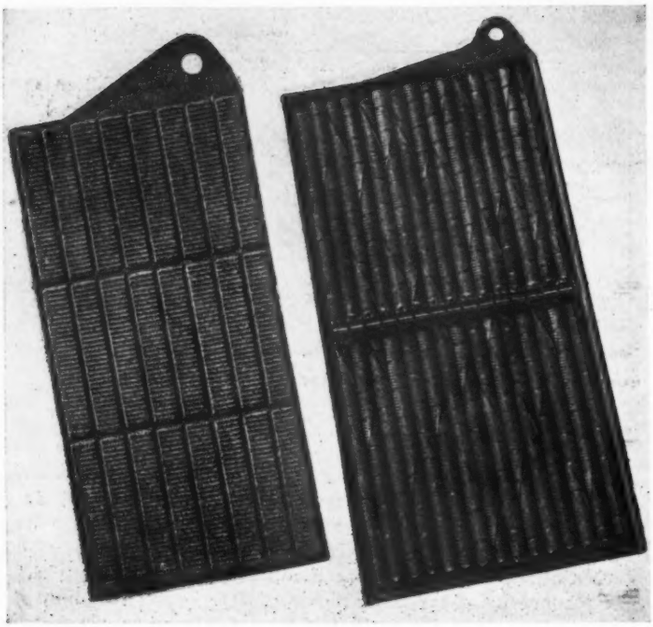


Fig. 1—Positive and negative plates of Edison battery. The negative, which is shown at the left, is composed of 24 rectangular shaped pockets arranged in three rows of eight to the row and each pocket filled with iron oxide. At the right the positive plate is illustrated. It is made up of two rows of ribbon tubes, each tube filled with iron sulphate and flake nickel arranged in alternate layers

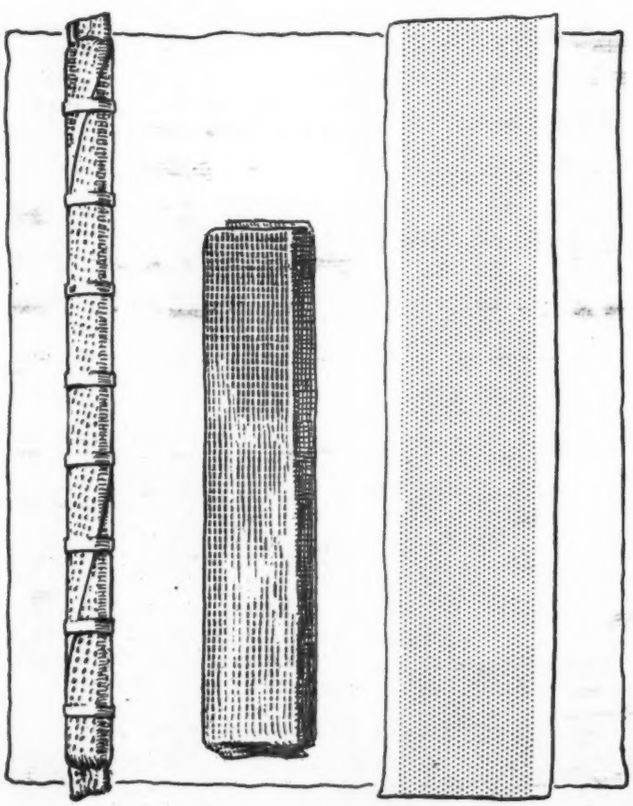


Fig. 2—At the left is one tube from a positive plate shown in actual size. It is approximately 4¼ inches long and ¼ inch in diameter. At the right is the ribbon from which this tube is made, this being steel ribbon, nickel plated and finely perforated. In the center is the smaller rectangular pocket for the negative plate. It measures approximately ½ inch wide, 3/16 inch thick, and 3 inches long. Special machinery is used for this work in order to keep the cost of production down

Tubes and Pockets of the Edison Battery

Stages in Making These Two Elements That Are Warp and Woof of Cell

A LITTLE tube 4.5 inches long and not larger in diameter than a lead pencil and a little oblong-shaped flat tube 3 inches long, half an inch wide and scarcely 3/16 inch thick are the two essentials of the now famous Edison storage battery.

Just two essentials, a round tube and a flat tube; both are illustrated in actual size in Fig. 2. These two with what they contain would make a real battery, true not of much capacity, yet in them are the essentials. To make a real battery, one to propel a car or a truck, more of these little tubes, round and flat ones, are used. Just as 100 cents make a dollar so do enough of these tubes make a battery when properly arranged.

These tubes are simple little affairs and there is nothing startling in what they are filled with, yet, to bring them to their present status required a series of 55,000 experiments by a corps of efficient chemists under the direction of Thomas A. Edison, whose name the battery bears.

Let us look first at these little tubes and afterwards at what they are filled with. To make these tubes has called for building special machines, machines designed solely for this work. Both the round and the flat tube are made from ribbons of steel, a piece in actual width being shown in Fig. 2. To make a tube from a ribbon is not difficult but to prepare the ribbon and manufacture it in quantities has called for much expenditure of grey matter.

Preparing the Ribbon

First the preparation of the ribbon: It is a carbon steel ribbon .005 inch thick and almost an inch wide, that is the ribbon for making the round tube, that for the flat tube is narrower. First this ribbon has to be perforated in order that chemical action can take place. Fig. 3 shows how this is done. The ribbon is fed between two rollers, one of which has small projections on its surface and the other corresponding depressions. One is described as a male roller, the other a female. The ribbon, after passing between these rolls, comes out filled with regular square holes, so small that twenty are needed to the inch, but they are regular in rows from side to side and each as accurate as can be.

This done the ribbon goes between emery wheels that smooth both sides and take off any little burrs that might remain after the perforation process. But its troubles are yet far from an end. The emery wheels fill up the little perforations, and to clean them the ribbon is next fed through a machine with six revolving brushes, Fig. 4. It zig zags up and down through this machine, two brushes rubbing on one side, two on the other and in between are two more that rub crosswise on the ribbon so that when it emerges every perforation is as clean as clean can be.

The ribbon is now ready to be nickel plated, in order that it may not rust when in contact with the liquid in the battery. After passing through the nickel bath it goes to a hydrogen furnace where it is heated to a cherry red and annealed to make it very pliable. The heat of the furnace also melts the nickel plating so that it is partly absorbed by the pores of the steel, thus becoming an integral part of the ribbon so that there is no danger of the nickel coating chipping off. Six special nickel plating machines are used in this work.

Making the Round Tube

The ribbon has now finished its preparatory journey and is ready to be made into round tubes or flat tubes as the case may

be. Fig. 5 shows how it is in one machine made into the round tube and cut into the desired lengths without the hand of a single workman. At the right is the reel of ribbon that feeds automatically into the machine. First it goes through a shaping die that not only forms it spirally into a tube, but the edges of the ribbon are lapped over each other, forming a perfect joint so that soldering is not needed. This lapped-over seam is pressed flat and as a last operation the tube is cut the correct length and dropped into a receptacle.

The manufacture of the flat tubes or negative ones is not so interesting. These negative pockets, as Edison designates them, are formed in halves from ribbon by groups of punches which cut the halves in required lengths and stamp them into form, 2 seconds being needed for each. These halves are not unlike the well-known paper box in which the box proper and cover are equal halves one fitting over the other. They are then washed in gasoline and the halves slid together, forming the pockets.

With the two essentials of the battery now made the filling of them is the next operation. To fill the round tube is the big job; the flat one is a relatively simple operation. Before telling about the filling it is well to understand that the round tube is the positive one, and when thirty of them are put together they make up a positive plate for an Edison cell. Fig. 1 shows how they look when arranged in two rows, fifteen in a row in the steel grid or framework that contains them. The flat tube is the negative plate.

700 Layers Per Tube

The positive plate is filled with two substances, pure flake nickel and nickel hydrate. They are filled in layers in the tube, one layer of hydrate alternating with layers of pure nickel until the tube is full, but to fill it there are 700 layers, 350 layers of the pure nickel and 350 layers of the pure hydrate. How this is done will be told later.

Pure nickel is not a difficult metal to obtain, but to get it in the form Edison needed it to do the work in these little tubes was a man's job, in fact the job of a whole corps of chemists. Edison had to get the nickel very thin, so thin that it would take 16,000 sheets of it to make 1 inch in thickness. To do this meant building a new factory unit to house the special machinery to get such inconceivably thin sheets of pure nickel.

The machine which makes it is shown in Fig. 6, at least this is one of the several machines that do the work. This machine is a huge traveling crane suspended from an iron track overhead and moved back and forth by an electric motor, which the man shown at the left controls. This machine carries ten vertical copper cylinders, each 10 inches in diameter and on these the thin nickel is made. These cylinders are rapidly revolving and are dipped into copper and nickel baths alternately, these baths being shown in the form of barrels in the floor.

The rotating cylinders are first submerged in the copper bath for a few seconds while a thin layer of copper is deposited on

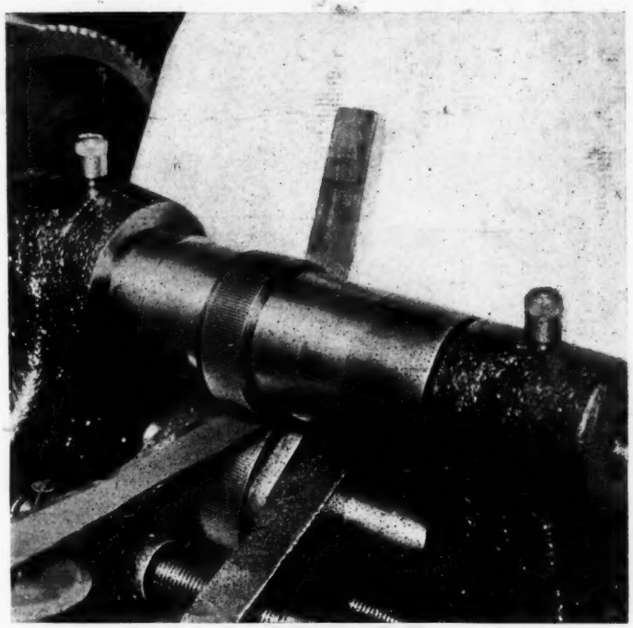


Fig. 3—The ribbon being perforated by passing between male and female wheels or rolls

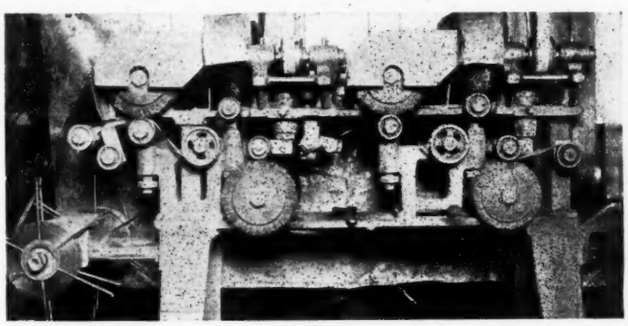


Fig. 4—After the ribbon is perforated it is run over 6 brushes which clean the perforations, 2 brushes working on one side of the ribbon, 2 on the other, and 2 crosswise

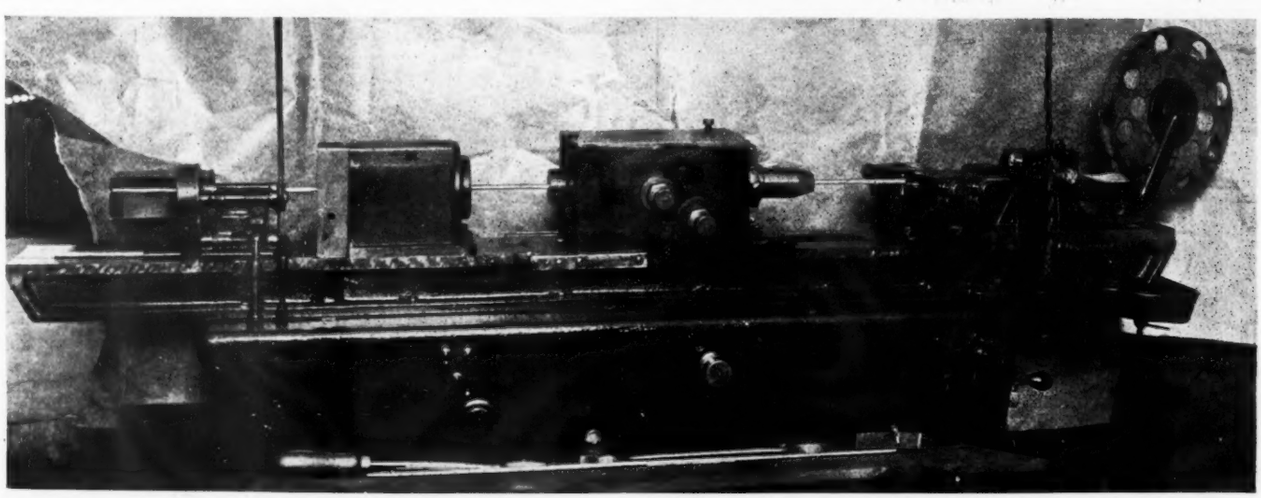


Fig. 5—Once the ribbon is completed it has to be formed into the small tubes for the positive plates, which is accomplished on this machine. The perforated ribbon is seen on the reel at the right, and as it passes through the machine it is formed into a tube with the edges lapped and at the left end is cut to the proper length

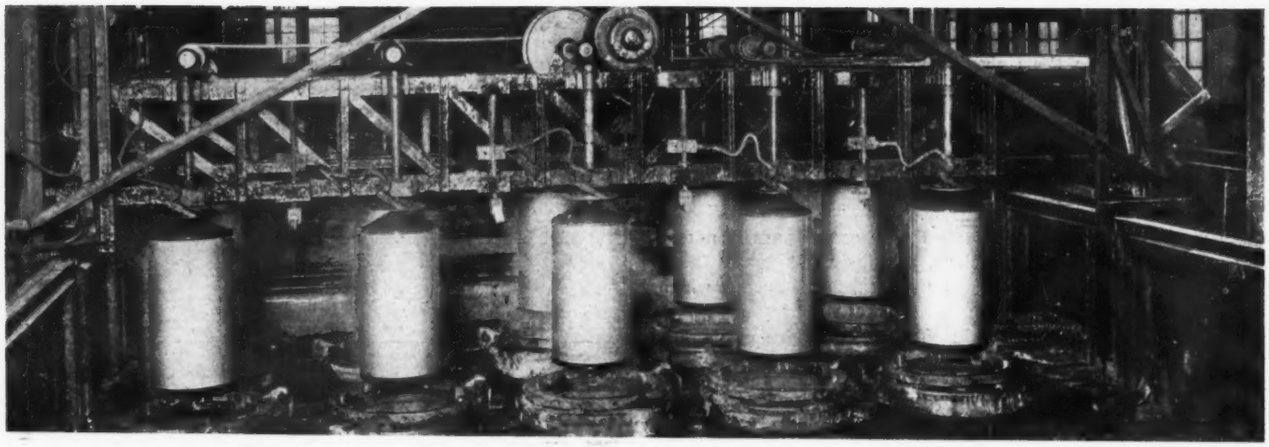


Fig. 6—One of the cranes which carries ten cylinders on which copper and nickel are alternately deposited from the baths into which these cylinders are dipped. There are 125 layers of copper which alternate with 125 layers of nickel, these 250 layers forming a sheet 1/64 inch thick

Fig. 7—Removing the sheet of nickel and copper from one of the cylinders. The sheet is cut on one edge and then peeled off

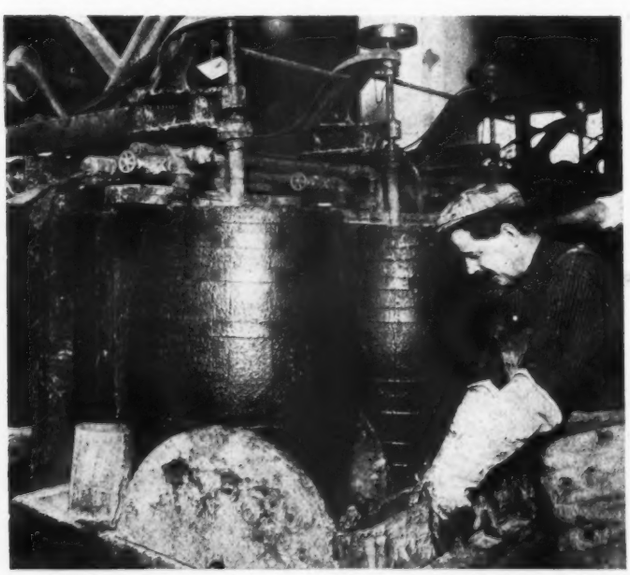


Fig. 8—This shows the agitators, which contain a solution which dissolves the 125 thicknesses of copper deposit from the 125 thicknesses of nickel, thus leaving the nickel in thin flakes

them. Then they are lifted out and moved along past multiple water jets that spray on them before they are lowered into a row of nickel baths where a film of nickel is deposited over the copper film. Out of the nickel they pass under more water jets and then into other copper baths. This program of copper and nickel with the water washing sandwiched between is continued until there are 125 layers or films of copper and 125 films of nickel, 250 films in all.

These sheets are then peeled off the cylinders. Fig. 7 shows how the deposit is first cut from top to bottom and then stripped off. Once off it is rolled flat and cut into pieces ¼ inch square.

The next problem is to separate the copper from the nickel in these little squares. To do this the squares are put into agitators or barrels with revolving parts inside and filled with a solution that dissolves the copper films from between the nickel, so that all that remains when the agitating action is completed are the thin films of pure metallic nickel ¼ inch square.

Filling the Round Tubes

Next comes the filling of the round tubes, the positive ones. Special machines had to be designed to do this work. Fig. 9 shows the side of a machine and Fig. 10 the end of one. This machine fills eight tubes at once, inserting the 350 layers of pure nickel alternated with 350 layers of nickel hydrate and rams each down with a force of 2,000 pounds per square inch. The eight tubes to be filled are inserted in a mould which has a recess into which each tube fits, this mould being not unlike that used by a foundry man excepting that it is all metal. The end view of the machine shows a hopper-like receptacle at one side containing the flake nickel and a similar one at the other side filled with nickel hydrate. The machine is so designed that the required amount of flake nickel is dropped into the tube, then packed and followed by the correct weight of nickel hydrate.

Once filled little metal caps are inserted in each end of the tube, the ends are then crimped over, Fig. 11, and lastly eight little steel rings are slipped over each tube and pressed into position, these rings preventing the tube expanding.

The tubes are now completed and ready to be put into the frame work or grids ready for assembly. But it would not be complete if a word were not said about the inspection of these little tubes from time to time during their manufacture and after they are filled. To make sure that the loading machines do their work properly one tube is taken out of every-so-many filled by each machine and cut in half. One half is then placed under the microscope, Fig. 13, to see that the layers of flake nickel and nickel hydrate alternate properly. If they do not the lot of tubes from which the test specimen was taken are discarded and the machine inspected and corrected.

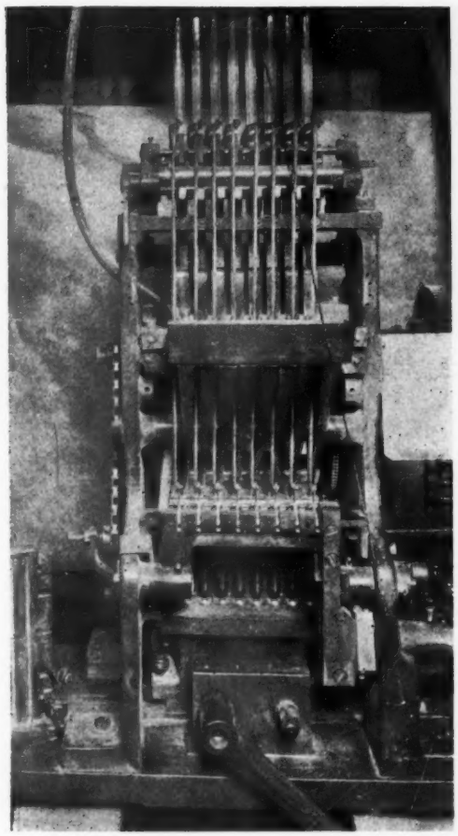


Fig. 9—Side view of special machine used to fill the tubes of the positive plate. This machine deposits alternate layers of metallic nickel and iron oxide, 350 layers of each in each tube

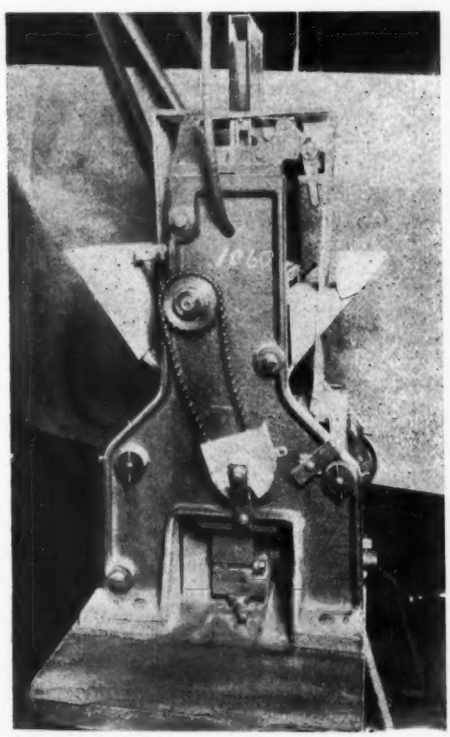


Fig. 10—End view of special machine for filling positive tubes, showing hopper receptacles at opposite sides, one filled with flake nickel and the other with iron oxide

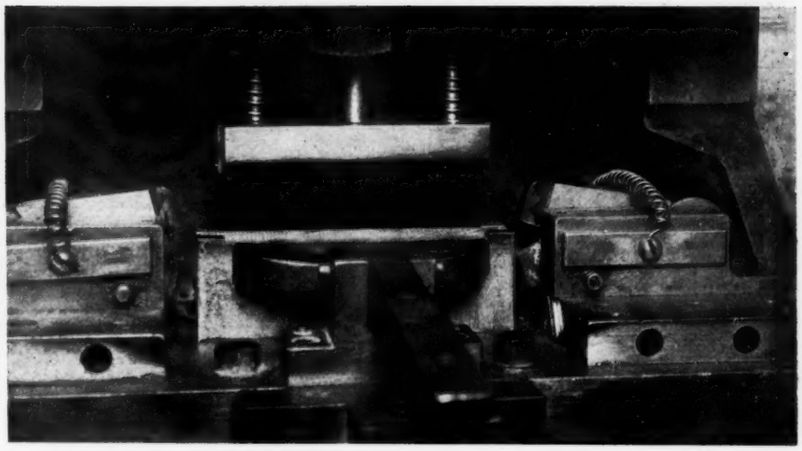


Fig. 11—After the positive tubes are filled the ends are capped inside, and, this done, are pinched, which is accomplished by the open jaws seen at the right. The overhead press first comes down holding the tube in position, after which the jaws close, accomplishing the pinching act

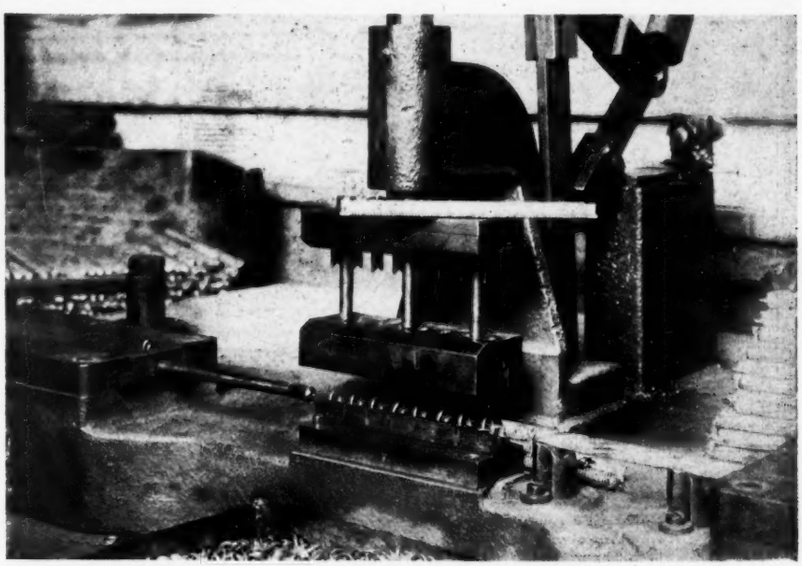


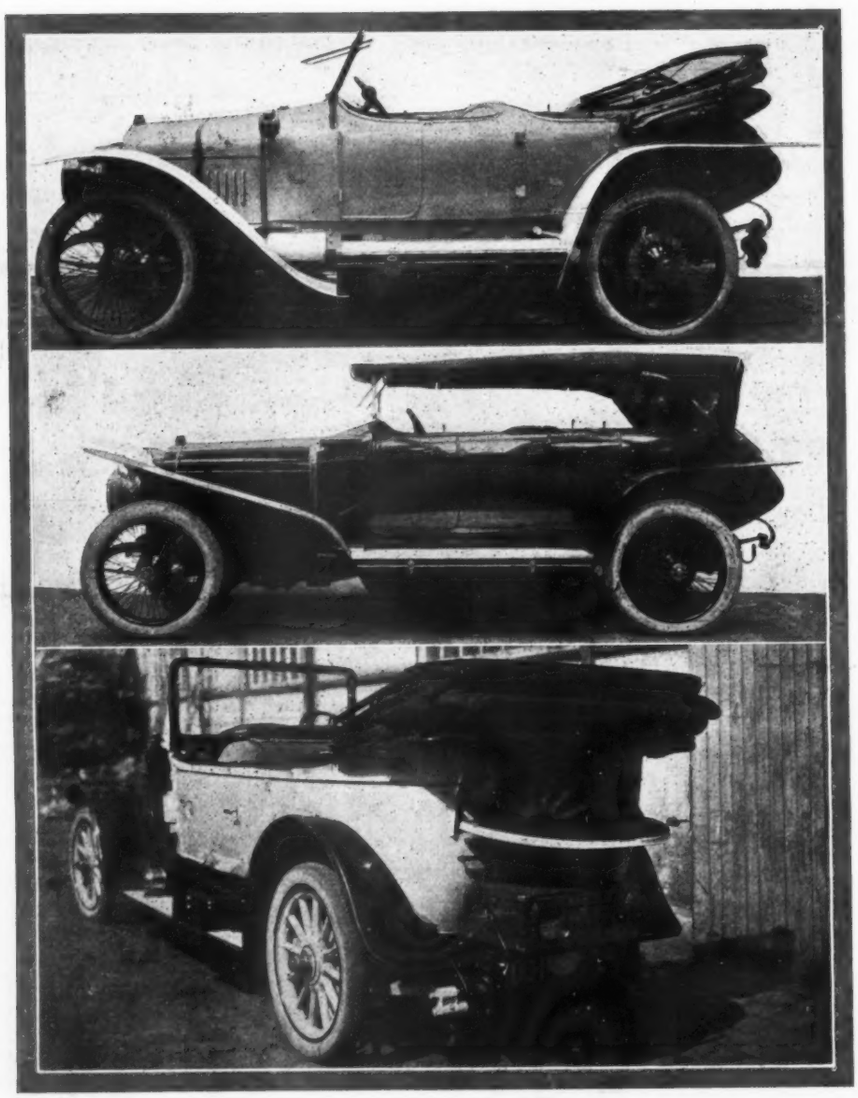
Fig. 12—When the tubes are filled they are fitted with 8 rings, which prevent expansion and bursting of the tubes, which would allow the filling to escape. These rings are first put in position, the tube then inserted, and the press does the remainder

Fig. 13—The utmost care is taken in inspecting the positive tubes to see that they are filled with alternate layers of flake nickel and iron oxide. To make certain of this one tube in every given number manufactured is sawed longitudinally from end to end and one-half inspected before the microscope as illustrated herewith. Should the filling machine have failed in proper alternating of layers of nickel and iron oxide it will be detected by this inspection

Four-Cylinders Predominate At Paris Show—Sixes Lose

America Leads Outsiders in Numbers—England Second—Electric Lighting Popular—Few Self-Starters—Body Improvements Seen Everywhere—Briscoe Has New Car—Show Is Pure Business Proposition

By W. F. Bradley



New Paris Body Fashions

Fig. 1—Touring body with stream lines from radiator to rear and tumble-home sides in which the sides curve inwards at the top

Fig. 2—Sporting type of runabout body with tumble-home sides, sheet fenders and rear compartment for spare wheels and baggage

Fig. 3—Lamplugh body on Renault chassis provided with rear locker for spare wheels which does not in any way interfere with baggage rack carried on rear of chassis

PARIS, FRANCE, Oct. 17—*Special Cable*—The Fourteenth Paris Salon opened in the Grand Palais today with 898 exhibitors, twelve more, by actual count, than crowded the Palais a year ago. There is not room for all of the exhibitors, not because the number is any greater, but because of the demand for larger space.

From today's opening, it is at once evident that the Salon of this year will not be as international as Olympia, to be held in London next month, gives promise of being. Of the 898 exhibitors 830 are French. America leads the foreign contingency with twenty-four exhibitors including such names as Cadillac, Hudson, Packard, Studebaker, Overland, Buick, Mitchell, Hupmobile, Ford, Case, Abbott, Benjamin Briscoe's new car, and such accessories as Stewart speedometer, Vacuum oil, Warner speedometer, Bowser tanks and Oildag.

Next to America lending an international flavor to the Salon is England with twenty-three exhibitors, and then come the following: Italy 8, Germany 8, Belgium 5, a total of sixty-eight in contrast with 830 French concerns alone.

Today's Salon opening shows that the four cylinder small car still occupies the presidential row, and that the small six has not made the showing expected, there being really only one French maker, Delaunay-Belleville, paying any serious attention to it, so that in the eyes of all other French builders the six has really received a set-back.

The Four-Cylinder Still Leads

The four predominates, and its characteristics are a block motor with L-type cylinders and a stroke slightly longer than this year, although the stroke-bore ratio does not average any higher than for 1913.

The Knight motor continues in force, being represented by Panhard, Clement, Mors, Gregoire and other French makers, not to speak of representatives from other countries. With the Knight

exception the non-poppets have gone back. They are not in as much evidence as one year ago.

Everybody looks for novelty row at the Paris Salon, and this year electric lighting certainly occupies the spot-light. The French makers are enthusiastic on it. It has made a startling conquest.

There are self-starters on a small number of cars, but they are generally charged for as extra equipment. The starter movement has not taken hold like the electric lighting.

The 133 chassis which are on exhibition on the various stands show that much progress has been made in the refinements of springs and brakes, as well as in motor compactness and accessibility.

The cyclecar movement has exerted its force and exemplifies itself in a tendency towards small four-cylinder motors.

New Benjamin Briscoe Models

From an American viewpoint the new car of Benjamin Briscoe is of interest. It is a five-passenger model which will probably be listed at $900, and together with this is a four-cylinder cyclecar selling complete at $390. It is understood that arrangements have been completed for building these for the European market as well as for their construction in America. The new touring car is a four-cylinder unit construction, cylinder 3.1 by 5.1 L-type with inclosed valves. Lubrication is by circulating system; there is a three-speed gearset, and two sets of rear wheel brakes. The wheelbase measures 105 inches and the weight is 980 pounds. The body is a five-passenger European type without a break from bonnet to rear.

Today's show is the first of the European season, Paris this year coming before London and thereby securing additional importance. Expenditure on the show will doubtless exceed the sum of $200,000. The joint committee responsible for the show has the advantage of securing the use of the finest exhibition hall in the world at practically no other cost than indemnities to a few small bodies having been housed to make room for them. Stands are furnished to the exhibitors completely fitted up and decorated, the cost of the best and largest places being $4,000. Under the new method of management, exhibitors are entitled to share in the profits. Last year the exhibiting firms having a membership in one of the trade organizations responsible for the Salon were refunded 35 per cent. on their stand rental, and non-members 16 per cent. President of the joint committee running the show is Louis Renault.

There are numerous innovations in this year's show. After living through a period of lavish display, when even the adjoining streets were included in the sumptuous decorative scheme, there was a short period during which an attempt was made to abolish shows. This was followed by an experiment with shows every 2 years, and has been succeeded by the present decision to hold an annual show of an artistic nature, but on sound business lines with no attempt to bring the crowds in by world's fair methods.

No Free Tickets

Instead of crowding the hall to suffocation on the first day by the very simple expedient of distributing, free tickets, not a free pass was given out today. Instead, the price, which is normally 20 cents, was increased to $1, thus making sure that only those persons really interested in automobiles would be brought into the hall. Next Friday the price will be increased to 60 cents, and on Monday, October 27, the last day of the exhibition, the late comers will have to pay $1 to pass the turnstiles.

There is now no necessity to seek to stagger the crowds by thousands of lights and a wealth of decorative matter. The masses are converted to the automobile and the problem now is to get in the greatest number who are purchasers or likely to become immediate purchasers.

The change of date from December to October has also been made from economic reasons. After the Summer season there is a slackening off at the factories and full work is not taken up until the show has come to a close. Thus the earlier the show can be held the shorter the slack period in the shops. While this change will make for internal economy, it has the additional advantage of making Paris the first show of the season and therefore attracting dealers, and particularly foreign dealers, who would otherwise visit the London exhibition. The Paris show is not so international as the one at London, but under every other heading it has a decided advantage over its rival. It is an absolutely complete representation of the Continental automobile industry, the only European country which is not fully represented being England.

America Gets Fair Show

American firms are more numerous than last year and it is worthy of note that they are not the same as last year. The Hudson Company occupies stand No. 1, a choice position directly opposite the main entrance. This is ample proof that a foreign firm can receive generous treatment at the hands of the Paris show committee. A turn of the wheel gave Hudson this position, but the system under which lots are drawn is such that there is very little difference shown between home and foreign firms.

The Grand Palais is this year too small to nold all the exhibits. This is not due to the increased number of exhibitors, for the figures are only about one dozen higher than last year, but to the fact that firms have asked for bigger stands than ever before. The amount of space rented in the main hall is 252,000 square feet. In order to provide for commercial vehicles, a special building has had to be erected on the banks of the Seine, about 50 yards from the Palais. Permission to erect this tem-

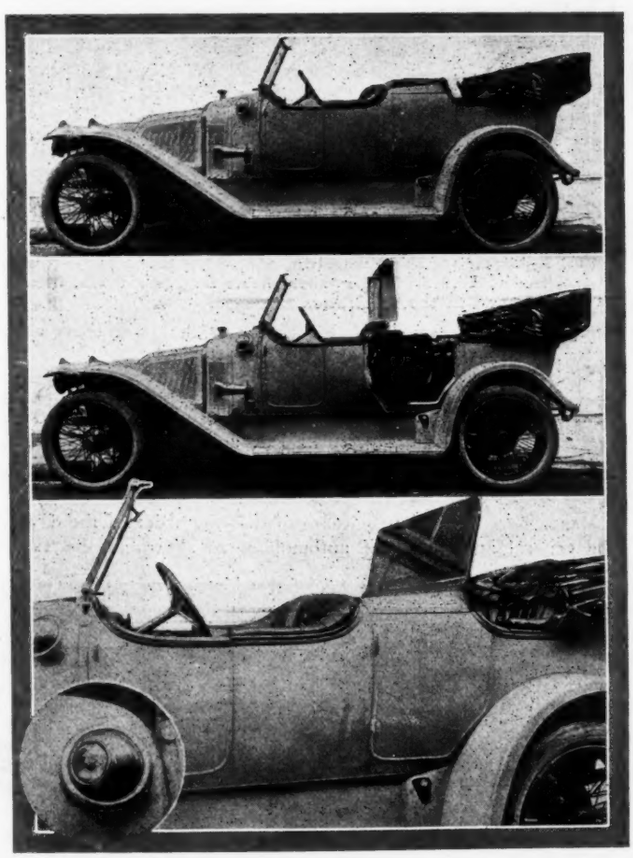


Fig. 4—Schneider touring car body with deck in rear of front seat folded

Fig. 5—Schneider body showing deck in rear of front seat raised, forming windshield

Fig. 6—Schneider body showing lines of tumble-home sides; also raised windshield for rear seat and swiveled eye-type dash lamp

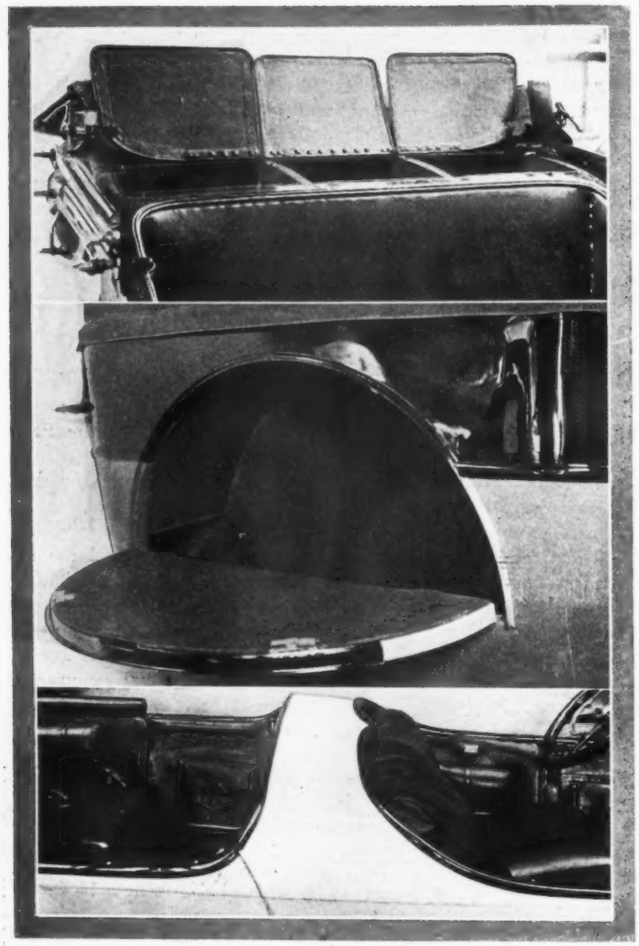


Fig. 7—Cupboard above spare wheel locker on Lamplugh body, these cupboards making suitable baggage-carrying spaces

Fig. 8—Locker for spare wheel in rear of Lamplugh body. Inside of this locker there are two smaller chests for spare tubes, neither of which shows in the illustration.

Fig. 9—Scuttle construction at the rear of the front seats on a Charron body built by Lamplugh

porary building was not granted until very late, but within 5 days of the order being given a stout wood building with big glass windows had been put up and roofed. The number of exhibitors in the commercial vehicle section is twenty-three, occupying 9,700 square feet of space.

PARIS, FRANCE, Oct. 10.—Refinement is the order of the day in the general appearance of automobiles as shown at the Paris Salon. It is now impossible to sell a car, whether it be a 6-horsepower runabout or a powerful touring model, with an abrupt break at the dashboard and discontinuity in its lines. The most conservative manufacturers, who have clung to their own particular type of bonnet and dashboard as if they were family heirlooms, have had to give way before this modern movement, and so dispose their bonnets that they will harmonize with the body to be put behind them. Delaunay-Belleville is a good example of this. The radiator is distinctive; it is round, and naturally suggests an engine boiler, on the manufacture of which this firm's reputation was made before it secured success in the automobile field. Now the bonnet has been modified, the gasoline tank has been placed behind it, there is no break between bonnet and tank, and it is possible for the coachbuilder to so lay out his work that there will be no break between tank and body.

Make Radiators Harmonize

After making the bonnet so that it will harmonize with the body, car manufacturers have gone a step further and have made their radiators harmonize with the whole. The tendency is toward gentle curves: everything is rounded off; there is no abrupt break anywhere; even the mudguards are domed, everything is being cleared off the running boards and a visible door handle is an abomination. Yet at the front end of the car there was a sharp break from the flat radiator to the gently sloping bonnet. This harsh effect has been got over by rounding off the top and the sides of the radiator, so that the car begins sweetly, and not with a sudden jerk shocking to the eyes. Peugeot appears to have been the first to adopt this, but others were not long in following. It is only a detail, but it is remarkable what an effect it has in softening the lines of the car. Other makers have not only rounded off the angles but have made the radiator more or less pointed. Carried to extremes, a harsh effect is again obtained. It is a difficult matter to get a really good effect, and there are some makers who would have been well advised to leave their radiator flat and merely round off the angles. Panhard has adopted the slightly pointed radiator with very pleasing results. The pointed radiator has the additional advantage of slightly cooling the area of the cooling surface.

Metallurgique claims to have a patent on the pointed radiator and has threatened court proceedings; nobody appears to be scared, however, by the threats. Gasoline tanks are no longer carried under the seats. They are most often placed on the front of the dashboard, right across the frame, the top forming a continuous line with the bonnet and the scuttle, or they are mounted on the rear of the dashboard or under the scuttle dash. The rear tank under pressure is found on a rather smaller number of cars than formerly. Both tank and radiator fillers are being made very much larger than before, in some cases being big enough for the hand to be passed inside. The arrangement is not unsightly and it may be useful.

With the craze for a clean-cut car the problem is to stow away tools, tires, batteries, etc., in a convenient manner. Only a com-

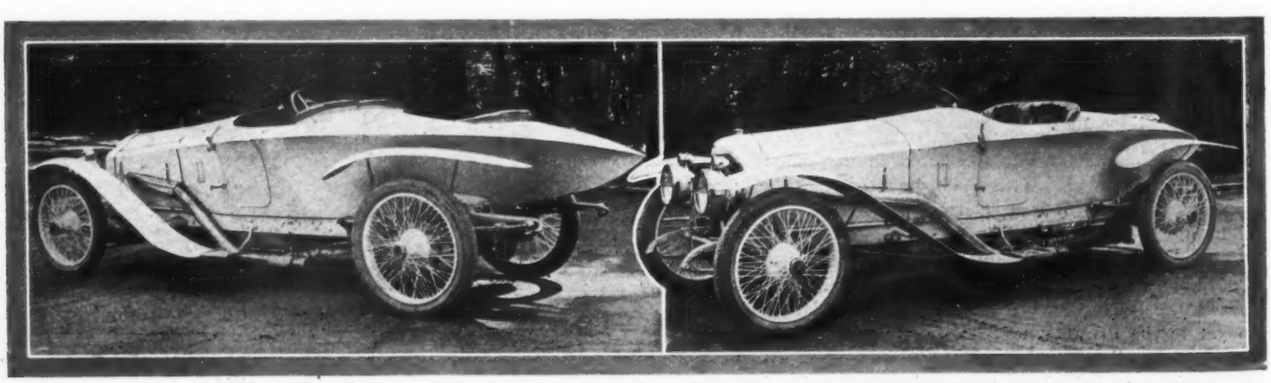


Fig. 10—Three-quarter rear and three-quarter front boat type bodies on Turcat-Mery chassis showing external exhaust manifold and concave sides. The rounded radiator frame is in conformity with the general lines of this body

paratively small number of complete high-grade cars being produced by the automobile manufacturer, this problem is left to the body-builder. Lamplugh has done some excellent work in this direction. In the rear panel he has built a locker of sufficient size to take a wheel with an inflated tire on it. The wheel is held in place without any straps, and the hinged door can be let down and the wheel taken out without interfering with a well-filled luggage rack. Near the bottom of this chest are supplementary lockers, also lined with felt, which are ideal for carrying spare tubes. Around the top of the big chest, with admission from the back of the car are three more small lockers suitable for tubes or spares. Under the rear floorboards and to each side of the propeller shaft, sheet steel trays are fitted. Under the front floor boards another sheet steel pan is specially designed to receive the battery. By this arrangement, everything connected with the car is stowed out of sight.

To provide accommodation for passengers' nick-knacks, Lamplugh has fitted up handsome cabinet work at the back of the front seats. From the outside this is hardly visible, for there is a kind of scuttle at the back of the front seats which further serves to enhance the lines of the car. From the inside the effect of these cabinets, in polished wood, is decidedly pleasing. This effect is shown very well on a Charron touring car, with bodywork by Lamplugh. The same car is fitted with Lamplugh Pullman seats. Both the back and the seat are entirely independent from the body and each one can be regulated for height and inclination to suit the passenger, at a moment's notice.

A very good effect is being obtained by abolishing the polished wood top rail on open bodies. Instead of there being an abrupt stop of the side panel and a piece of polished beading placed along it to give the necessary finish, the panelling is being brought right over from the outside to the inside and well rounded. This is particularly pleasing when the sides run into a scuttle at the back of the front seats, as is done on the Charron with Lamplugh body already mentioned.

Boat-Type Gains Adherents

In sporting circles there is a decided craze for boat-type bodies. Various body builders have taken this up with some very good effects. Turcat-Mery has produced several on lines which suggest a boat with its bow turned toward the rear. Alin & Liautard have built a series on Abadal chassis in which a striking effect is obtained by alternating the longitudinal planks of entirely different kinds of wood. This body is a three-seater partly decked over around the rear seat. Henri Labourdette has made a specialty of boat bodies with very good results. Half a dozen are being shown on Panhard, Peugeot and Abadal chassis.

Labourdette has two fore-and-aft oak members, on which he builds up ribs, exactly as in boat construction, and then puts on three layers of planking, two layers being diagonal and crossed, and the outer layer longitudinal. The bodies are polished in their natural woods, generally mahogany, the rival heads showing, as in real boat construction. The upholstery is merely buttoned in.

One of the great difficulties with a body of this nature is to make the car bonnet harmonize with the boat. On the Abadal the body maker has carried the planking over the bonnet, right up to the radiator.

Boat-Type Bodies Are Light

These bodies have the practical advantage of being considerably lighter than any ordinary type of body and infinitely stronger. A five-passenger body has but 130 pounds of woodwork. The complete weight of a boat body varies between 280 and 350 pounds, compared with 550 to 660 pounds for an ordinary type of body with equal carrying capacity. Built up on ribs with three layers of mahogany, the greater strength is evident. This has been proved in a very practical manner, for one of the first cars went into a tree at 40 miles an hour, and although the chassis was badly wrecked not a plank had sprung in the body. Henri Labourdette claims to have patented this construction and to have registered the design.

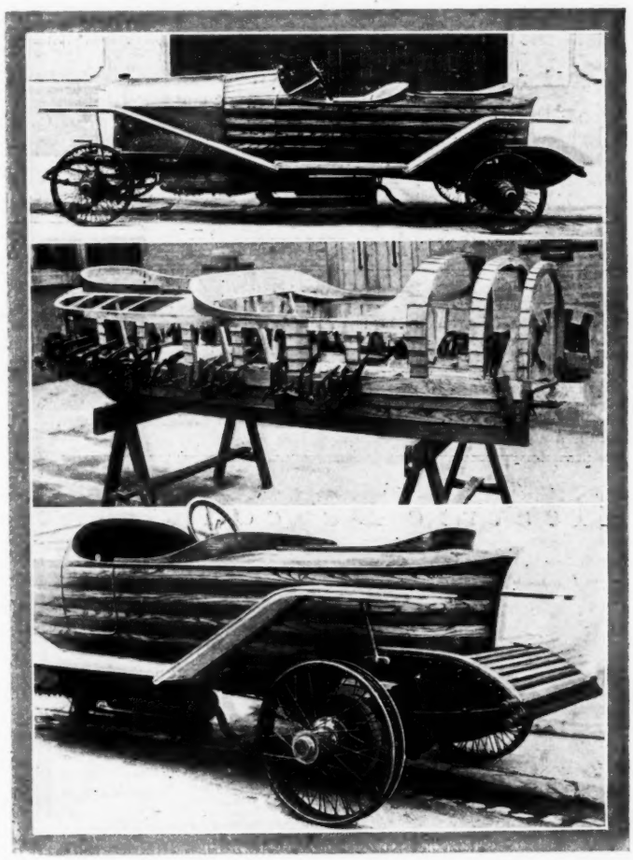


Fig. 11—Alin & Liautard boat-type body on Abadal chassis in which alternate lengths of planks of different kinds of wood are used

Fig. 12—Showing how framework is set up for Alin & Liautard boat-type body

Fig. 13—Three-quarter rear of Alin & Liautard boat-line body showing characteristic boat line

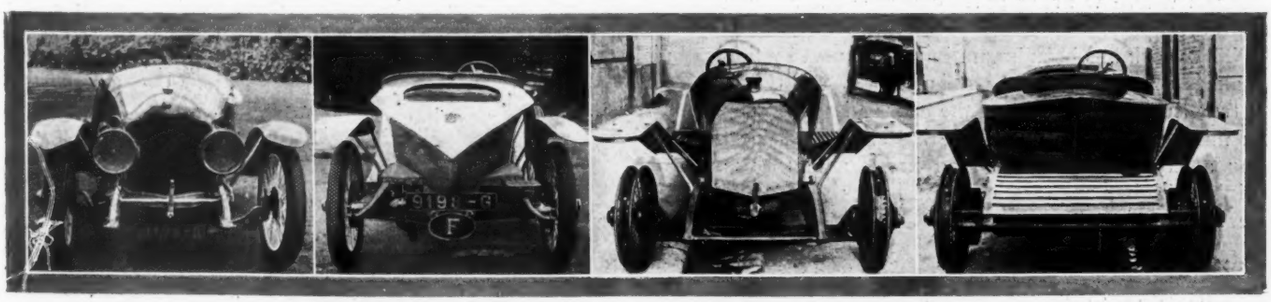


Fig. 14—Front and rear views Turcat-Mery boat-type body

Fig. 15—Front and rear views Alin & Liautard boat-type body

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Electric Beacon Lights

ECONOMY of battery current is the objective of the majority of makers of both electric passenger and commercial vehicles for next season. Economy and conservation, both necessary in that the radius of mileage per charge can be made as great as possible for the field of the electric, and its possibilities are directly proportional to the battery capacity and life.

Conservation of battery current is being attained in a commendable manner, not by the brute strength method of putting in 50 per cent. more cells if you want 50 per cent. more mileage, but rather by endeavoring to make the present capacity of the battery go further by cutting down the friction losses in the chassis and so avoiding that needless waste of current used to overcome poor bearings, poorly balanced chassis, imperfect steering, stiff spring action and a host of other troubles in the chassis where wearing parts consume their quota of the battery supply.

This work has been begun in real earnest by the leading makers of electrics, and particularly in the truck field is it true that the majority of the chassis improvements have in mind making the available battery capacity carry the car a little further, and also being able to use it for slightly higher accelerations and better speeds on hills if necessary.

Cutting Down Friction Losses

This story of cutting down friction in the wearing parts is a long detail one, but a few examples will show how the engineers are going after the subject in a businesslike manner and how some of them have practically revamped their line of commercial cars in order to cut down electric current losses and render the chassis more fool proof. The fitting of grease cups on every spring bolt and chassis bolt is bound to add its quota to easier car running; adding ball bearings in the steering gears to give easier handling will add its mite to battery conservation; fitting larger and more adequate bearings to carry both front and rear wheels and using improved means to keep the dust and dirt out and the lubricant in will certainly add a percentage to the increase of battery mileage; grease cups on all steering pivots, on steering cross links and on brake operating parts, will help; inclosing drive chains and running them in oil will eliminate much loss of battery power; mounting the motor shaft on imported annular ball bearings is being looked to by some makers as an economy of battery current; another group of makers are inclosing the controller in a weather-proof metal box instead of leaving it exposed to water and dirt, this added precaution being certain to add to its life and keep it in better working condition; grouping the motor, the battery connections and the controller so that the length of wiring is greatly reduced is bound to play its part in battery current conservation in that such a grouping and reduction in wiring length will prevent drop of voltage in the wiring; putting wires of larger cross section so as to give higher current-carrying efficiency and inclosing these wires in conduits which have all connections soldered and taped will work its part; space will not permit to go further in this array of improvements that the up-to-date electrical engineer is incorporating in his chassis, all for the one great, all-essential object, namely, conserving the electric current, making it go further and better than ever before.

Stepping on the Threshold

But do not stop here. Some of the makers have, others have not, and the really progressive ones are only on the threshold of this great battery conservation movement. There are boundless fields yet to be conquered. Another positive method of conserving current is that of cutting down chassis weight, and there is big room for progress. Two or three makers are now announcing the fitting of pressed steel frames in place of channel stock, claiming thereby not only a reduction in weight but also an increase in resiliency which should be beneficial to the battery, freeing it from a percentage, at least, of the vibration to which it is subject.

With the pressed steel frame it is possible to narrow the side members at the front so as to make the truck turn in a circle of much less diameter than formerly. This is commendable battery conservation, because if a truck has to reverse three times in making a turn, each reverse eats up its share of battery supply, and a heavy share because the entire load has to be started just twice that number of times. Make the maneuvering abilities of the truck better, make it possible to turn in a 40-foot street and you are making your battery capacity go a good percentage further.

Merit of Pruning Process

Cut down chassis weight wherever possible, should be the watchword. It costs just as much in electric current to carry 200 pounds of excess chassis weight around as it

does to carry that much useful load. It often costs more to carry the chassis load because not infrequently it is unsprung weight, which eats up more electricity than the sprung load carried over the springs. Makers can still reduce in chassis weight by using better grades of steel, substituting alloy steels where ordinary carbon steels are now used.

Not only will a better grade of steel do its part, but there is room for a nicer proportioning of the size of the part to the work it is intended to do. Cut a page from the experiences of gasoline racing cars in this respect, where weight reduction has been such a factor. With racing cars it has been possible to cut several pounds off without reducing the strength of the entire chassis and still leave the desired safety factors. Foreign car makers are experts in this work. Let the electric vehicle maker pursue this policy. Every pound he cuts off is money in hand to his own merchandising department and more money in hand to the buyer of the truck.

More Strength, Less Weight

Some makers will have to strengthen axles for future work, some have already done it, but not a few others have this work in store on some of their models. This does not mean adding more weight, but it does mean adding better materials, using better bearings, mounting them better, using better precautions to exclude foreign substances, and adding better lubricating facilities.

Using shaft-drive on lighter models is certain to give increased battery efficiency because of the inclosed nature of the drive and the fact that current is not needlessly consumed by mud and dirt reaching the operating parts. The adoption of the latest worm-driven axles is bound to make a showing in this respect, and the magnitude of this movement a year hence will be awaited with particular interest.

Let the makers of both pleasure cars and trucks realize first and last that current economy is the slogan. That with this increased battery efficiency with thinner plates and without adding to the weight is a second slogan. That better battery mounting, greater battery accessibility, so that the battery will receive daily attention, its cells be properly filled with electrolyte, its cells properly tested, connections kept in proper condition, etc., should be looked after wherever possible.

Direct Drive for Engineers

The electric engineer has a busy program before him. It is not child's play, but real man's work, man's work that calls for focusing of all energies.

This done, the tale is but half told. Production is to-day an essential of business. Up to the present it has not been a potent factor in the electric vehicle field, but the thin edge of the wedge has been entered and we are now started on the production era, that era when the maker producing in quantities will be able to cut prices from $100 to $500 per model, the same as has been done in the gasoline field. This condition is bound to come; it is already coming. Midnight slumbers are past; the morning of production in electrics has arrived, and those companies that are keeping production in mind in chassis design will win the laurels. Those who see otherwise will go the way of the many in the gasoline field during the last few years, who hopelessly tried to keep afloat on the ego of a small engineer, only to find themselves derelicts on the cruel sea of production.

U. S. India Rubber Imports 113,000,000 Pounds in 1913

Surpasses 1912 High Record by 3,000,000 Pounds

WASHINGTON, D. C., Oct. 18.—It will be interesting to the tire trade to learn that india rubber imports into the United States in the fiscal year 1913 were the largest in the history of the import trade. They amounted, in crude rubber, to 113,000,000 pounds, against 110,000,000 pounds in the former high record year, 1912, this being the third time in which the imports of this article exceeded 100,000,000 pounds in a fiscal year. These figures apparently sustain the frequently published assertion that the United States consumes half the rubber of the world, since the world's production of india rubber was, according to an authority, in 1912 100,000 tons, or 224,000,000 pounds, while our own imports in the year ended June 30, 1913, were 113,384,359 pounds.

The growth in the use of rubber in the United States is illustrated by government statistics, which show importations of india rubber in 1890 of 34,000,000 pounds; in 1900, 49,000,000 pounds; in 1910, 101,000,000 pounds, and in 1913, 113,384,359 pounds.

The world's production of rubber, according to the authority above mentioned, was: In 1905, 61,000 tons; in 1910, 70,000 tons, and in 1912, 100,000 tons, while the estimate for 1913 is 115,000 tons. The rapid increase in the share of the world's rubber, which is obtained from cultivated trees, is illustrated by the fact that in 1905 less than 1 per cent. of the world's rubber was obtained from plantations, the remainder being from natural forests, while in 1912 27.5 per cent. was obtained from plantations. The estimate for 1913 allots 40 per cent. of the production to plantations, the quantity of cultivated rubber having grown from 145 tons in 1905 to 8,200 tons in 1910, 27,500 tons in 1912, and an estimate of 45,000 tons in 1913.

Brazil still supplies more of the india rubber imported into the United States than any other country, but the percentage of the imports supplied by Brazil is now materially less than a decade ago. The share of the crude rubber imports drawn from Brazil was 56.6 per cent. in 1903 and 38.4 per cent. in 1913, while the share drawn from the United Kingdom (in whose colonies are found most of the rubber plantations) was 17.7 per cent. in 1903 and 30.1 per cent. in 1913. The quantity of india rubber drawn from the East Indies is also rapidly increasing, having been in 1903 less than half a million pounds and in 1913 more than 12,000,000 pounds. The prices of that arriving from the sections of the world in which most of the "plantation rubber" is now produced are now materially higher than that from the chief source of the natural supply—Brazil. The average import price of the rubber drawn from the United Kingdom in 1913 was 98.3 cents per pound, that from the East Indies 97.3 cents, and that from Brazil 59.5 cents; the average import price per pound of the entire importations of india rubber in 1913 having been 79 cents, against 84 cents in 1912 and $1.06 in 1911, the high record year in the import price of india rubber.

The 113,000,000 pounds of crude rubber imported into the United States in 1913 is, by no means, the entire supply of material of this character brought from abroad. The year's importations of india rubber and "substitutes for" include, besides the 113,000,000 pounds of crude rubber, 45,000,000 pounds of gutta joolatong, 10,000,000 pounds of guayule gum, over 1,000,000 pounds of balata, nearly 500,000 pounds of gutta percha and 43,000,000 pounds of rubber scrap or refuse fit only for remanufacture. The 45,000,000 pounds of gutta joolatong and 10,000,000 pounds of guayule gum, both of which serve in a limited way as substitutes for rubber, are much lower in price, the average import price of gutta joolatong being about 5 cents per pound and of guayule gum 42.5 cents. The scrap rubber, which consists chiefly of old rubber shoes, boots, belting and motor car tires, amounted to 43,000,000 pounds in 1913, against 26,000,000 pounds in 1912, averaging about 8 cents per pound, and coming chiefly from Russia, Germany, England and Canada.

Lowe Co. Answers Barber

Motor Car Equipment Co. Files Demurrer in Same Suit

NEW YORK CITY, Oct. 21—The first of the alleged infringers, the Lowe Motor Supplies Co., sued by William Barber has filed an answer. On October 2, it will be remembered, William Barber filed a suit in the United States District Court for the Southern District of New York, claiming a basic patent infringement against the following concerns: the Smith-Haines Co., the Motor Car Equipment Co., and the Lowe Motor Supplies Co., all accessory concerns in this city. He claimed a basic patent on the type of spark plug which bears the names Red-Head, V-Ray and Sootless. Mr. Barber's patent No. 732,032, of June 30, 1903, refers to a spark plug wherein the porcelain is inside the bushing at the ignition and extends part way back through the plug toward the cable end. The remainder of the insulating material is specified as being of some substance less brittle than porcelain.

In its answer, the defendant denies parts 2, 3, 4, 5, 6, 7 and 9 of the complaint, that it has any knowledge or information sufficient to form a belief as to any of the allegations of the complaint in the mentioned parts. The substance of the answer is as follows: It denies that William Barber is the inventor, that on September 17, 1913, Ada Barber assigned all her rights to the invention, to William Barber, that it did not use sparkplugs which had stamped in the metal "patented," that it did not offer for sale at its store at 1770 Broadway, any spark plugs with the alleged infringements, but admits it offered for sale sparkplugs known as the Red Head Magneto Plug combinations, and does not believe that these are similar to Exhibit A, the alleged infringed spark plug, and denies ever selling 10,000 spark plugs, with the infringements as stated in Part 9 of the complaint.

As a first, separate and distinct defense to the alleged cause of action set forth in the complaint, the defendant alleges, that the said invention 732,032 was not an invention when produced by Mr. Barber, and for a second defense alleges that the said invention was not new and useful when produced, and denies it is guilty of the said supposed grievances laid to its charge.

Automobile Securities Quotations

No changes of any import occurred in this week's automobile securities quotations. Ajax-Grieb Rubber Co. common, rose 5 points and the Goodyear Tire & Rubber Co. common, dropped 9 points.

	1912 Bid	1912 Asked	1913 Bid	1913 Asked
Ajax-Grieb Rubber Co., com	150	165	155	..
Ajax-Grieb Rubber Co., pfd	94	98	95	100
Aluminum Castings, pfd	100	102	98	100
Chalmers Motor Company, com	..	..	98	102
Chalmers Motor Company, pfd	..	..	94	102
Consolidated Rubber Tire Co., com	10	15	35	37
Consolidated Rubber Tire Co., pfd	50	60	90	95
Firestone Tire & Rubber Co., com	270	275	265	267
Firestone Tire & Rubber Co., pfd	106	107½	102	103
Garford Company, preferred	99	100	85	90
General Motors Company, com	36½	37½	38	39
General Motors Company, pfd	78	80	76½	*79
B. F. Goodrich Company, com	72½	73	20	21
B. F. Goodrich Company, pfd	106¾	107¼	85	88
Goodyear Tire & Rubber Co., com	375	380	275	282
Goodyear Tire & Rubber Co., pfd	105	106	97½	98½
Gray & Davis Co., preferred	..	..	..	102
Hayes Manufacturing Company	..	92	..	..
International Motor Co., com	17	19	..	5
International Motor Co., pfd	76	78	10	15
Lozier Motor Company, com	..	..	15	..
Lozier Motor Company, pfd	..	..	..	90
Maxwell Motor Co., common	..	..	1¾	2½
Maxwell Motor Co., 1st pfd	..	..	21	24
Maxwell Motor Co., 2nd pfd	..	..	5	7
Miller Rubber Company	130	140	130	135
Packard Motor Company, pfd	105½	107	95	100
Peerless Motor Company, com	..	..	25	35
Peerless Motor Company, pfd	..	..	85	90
Pope Manufacturing Company, com	30	34	..	8
Pope Manufacturing Company, p.d	70	74	..	28
Portage Rubber Co., com	..	..	..	35
Portage Rubber Co., pfd	..	..	..	92
Reo Motor Truck Company	..	10½	8	9
Reo Motor Car Company	..	23	16	17¾
Rubber Goods Mfg. Co., pfd	..	..	100	106
Stewart-Warner Speedometer Co., com	..	..	63½	66½
Stewart-Warner Speedometer Co., pfd	..	..	94	97
Studebaker Company, com	43½	44	19	20
Studebaker Company, pfd	94	97	73	78
Swinehart Tire Company	98	100	80	85
U. S. Rubber Co., com	..	..	57½	59
U. S. Rubber Co., 1st pfd	..	..	103½	104½
White Company, preferred	105	108	105	110
Willys-Overland, common	..	..	63	65
Willys-Overland, preferred	..	..	85	92

*Ex. Div.

Files Demurrer in Barber Suit

NEW YORK CITY, Oct. 21—The Motor Car Equipment Co. has filed a demurrer, in the United States District Court for the Southern District of New York, to the complaint of William Barber on alleged infringement of certain spark plug features.

It claims that the complaint does not state facts sufficient to constitute a cause of action, that it does not state that the infringement complained of was committed after the defendant had notice of the patent in the suit. It also says, in its demurrer, that the damages alleged to have been incurred by the plaintiff on account of defendant's infringement, are not stated specially, so that the defendant is not advised by the complaint of all the issues in the action.

Receiver Appointed for Mason Co.

WATERLOO, IA., Oct. 15—I. J. Hoover has been appointed receiver of the Mason Motor Co. of this city. The amount of bonds outstanding and due is $100,000. In the petition, F. W. Powers, trustee for the bondholders and plaintiff, demands judgment against the company in the sum of $100,000 together with interest on $36,000 due since July 1, 1913, and $64,000 due since January 1, 1912.

Stephenson Truck Bankrupt

MILWAUKEE, WIS., Oct. 22—The Stephenson Motor Truck Co., of this city, today was thrown into bankruptcy by three outside creditors, who say that the concern on October 8 admitted its inability to meet obligations and consented to bankruptcy. The claims of the petitioning creditors are small.

Three R. C. H. Corp. Creditors Petition for Involuntary Bankruptcy

DETROIT, MICH., Oct. 21—*Special Telegram*—Three merchandise creditors of the R.C.H. Corp., now in the hands of a receiver, have filed a petition in the U. S. District Court here before Judge Tuttle to place the corporation in involuntary bankruptcy. Their claims against the R.C.H. amount to about $10,000. Certain investigations are now under way to determine whether or not the present receivership policy is to the best interests of the creditors or whether it would be best to throw the corporation into bankruptcy. The court ruling which is expected next week will depend upon the findings of this investigation.

Receiver Appointed for Inter-State

INDIANAPOLIS, IND., Oct. 20.—Michael J. Broderick has been appointed receiver for the Interstate Automobile Co., Muncie, by the circuit court in that city. The receivership was based on a petition filed by Thomas F. Hart, president of the company.

Mr. Hart says that the company has liabilities amounting to approximately $500,000 and that the concern is insolvent. He says also many large accounts are due the company, which it is impossible to collect. The company has outstanding common stock amounting to $195,000 and preferred stock to the amount of $100,000.

According to Mr. Hart, there has been dissension among stockholders which has prevented the company obtaining additional money, which has been badly needed to carry on current operations. The stockholders are all wealthy men. The assets of the company include the factory buildings, equipment, several finished cars and accounts in the sum of $43,638.34.

Judge Frank Ellis, who appointed the receiver, has ordered that manufacturing operations continue until orders in hand are filled or until the supply of material is exhausted. The receiver has given bond in the sum of $300,000.

Schacht Property Is Sold

CINCINNATI, O., Oct. 20—*Special Telegram*—Between $35,000 and $40,000 was realized today by Ezekiel and Bernheim as auctioneers of the automobile chattels of the Schacht Motor Car Co., at Winton Place. The sale attracted the largest crowd of its kind in the history of the firm. During the morning thirty-six machines were sold. Not all were new, and some were un-

finished. Later in the day office fixtures and part of the equipment were sold. The sale will continue tomorrow. The real estate, consisting of what is generally known as the Cook Carriage Plant, on Spring Grove avenue will be offered on November 10. The stock and machinery had been appraised at $175,000, but not a bid for the purchase of the stock and machinery in its entirety was made. The auctioneer tried to induce a bid at $75,000, but there was no response.

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COLUMBUS, IND., Oct. 20—A judgment for $30,132 in foreclosure of trust deed proceedings has been obtained against the Indiana Motor and Mfg. Co., Franklin, Ind., by Albert L. McAlpin, trustee. The judgment was rendered in the circuit court of this city.

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International Meeting for Oct. 24

NEW YORK CITY, Oct. 22—The postponed meeting of the International Motor Co. stockholders, was adjourned until Friday at 11, after being in session about 2 minutes. A great many stockholders appeared at the company's offices, but they were not allowed to attend the meeting because technically they are not stockholders, but merely owners of voting trust certificates, which are held by C. P. Coleman, H. K. Pomroy and M. E. Kern, the voting trustees. One of the original stockholders of the Mack Motor Co., said that he thought a mistake had been made in taking in the Saurer truck at the time of consolidation. Another stockholder arose at the minority meeting, declaring that the new loan of $1,200,000 would be dissipated by the management, because from what he had learned, the management had no definite idea of what was going to be done, and considered cutting out the Mack and Saurer trucks. A motion was made that a receiver immediately be applied for, if the loan was not secured. After argument the resolution was changed to the effect that some application be made to the court.

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Fisk Net Earnings for 1913 To Run Over $900,000

CHICOPEE FALLS, MASS., Oct. 22—Net earnings of the Fisk Rubber Co., for its year to end October 31, will run between $900,000 and $1,000,000, thus fulfilling the expectations of the management when the $3,000,000 first preferred was offered for investment early this year.

Net profits of $900,000 would be over four times the $210,000 dividend charge in the 7 per cent. first preferred or stated in terms of the $8,000,000 common, would leave a balance for that issue of $550,000, or 7 per cent. The company has for the last few months been producing at the rate of 1,800 tires daily, and it will have a capacity of close to 2,500 tires daily when enlargements nearly finished are in productive swing.

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Board To Head Kentucky Wagon Co.

LOUISVILLE, KY., Oct. 18.—R. V. Board, of Boston, Mass., was elected president of the Kentucky Wagon Manufacturing Co., succeeding W. C. Nones, who recently resigned to become chairman of the board of directors, at a meeting of the directors held Friday. Philip S. Tuley, of Louisville, was elected vice-president. The concern manufactures the Urban electric trucks.

Mr. Board is now general agent in New England for the International Harvester Co. Officials yesterday sought to put a quietus upon reports that the local concern would be affiliated with the harvester company. It is generally known here that a plan to sell the local company to the harvester people was all but consummated 2 years ago, when legal entanglements were encountered. So-called "trust" activities of the government are said to have been partly responsible for the abandonment of the deal.

The company's attorney declared that Mr. Board would sever entirely all connection with the harvester corporation and that the wagon company would remain, as heretofore, a purely local enterprise.

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Jeffery Cross-Country Prices

NEW YORK CITY, Oct. 22—The Thomas B. Jeffery Co. has requested us to publish the prices of its cross-country model for 1914 in order to correct an erroneous impression that has gotten out. These prices for next year are: five-passenger touring car $1,875, four-passenger touring car $1,875, roadster $1,815 and Gotham $2,575.

Packard Dividend 40%

Surplus of $1,807,472 for 1913—Capital Increased $6,000,000

DETROIT, MICH., Oct. 18.—A stock dividend of 40 per cent. was authorized at the meeting of the stockholders of the Packard Motor Car Co. at the company's offices in this city on October 16. The directors' recommendations that the capital stock be increased from $10,000,000 to $16,000,000 were also approved, the additional being half common and half preferred, raising the total of each to $8,000,000 from $5,000,000.

Practically all of the stockholders acquiesced in the proposed plan of waiving their right of subscription to the $1,000,000 of new common stock, which amount will remain after the distribution of the $2,000,000 stock dividend, similar action being taken with regard to the $3,000,000 of new preferred.

For the present $1,000,000 of the new common stock will be retained as treasury stock, to be issued as funds are needed according to the requirements of the business. The $3,000,000 of preferred will also be held as a reserve to take up the company's issue of $3,000,000 in five-year 5 per cent. gold notes, due Dec. 1, 1916, and also for such other company uses as may be later determined. All of the directors and officers were re-elected.

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NEW YORK CITY, Oct. 21—The report of the Packard Motor Car Co., of Detroit, Mich., as of August 31, 1913, compares as follows:

	1913	1912	Changes
Net income after deposits	$2,157,472	$2,182,376	Dec. $24,904
Preferred dividend	350,000	350,000	.....
Surplus	*1,807,472	1,832,376	Dec. 24,904
Previous surplus	$1,198,784	.....	.....
Total surplus	$3,006,256	.....	.....

*Equal to 36.15 per cent. earned on $5,000,000 capital stock as compared with 36.6 per cent. earned on same stock previous year.

The balance sheet of the Packard Motor Car Co. as of August 31, 1913, shows assets as follows: Plant, $5 260,950; investment in branch selling companies, $1,481,894; miscellaneous investments, $80,733; inventories, $8,136,025; current assets, $2,226,406; expenses paid in advance, $153,840; total, $17,339,848.

Liabilities: Capital stock $10 000,000; gold notes, $3,000,000; accounts payable $1,154,875; reserves, $178,717; profit and loss surplus, $3,006,256; total, $17,339,848.

Market Changes of the Week

There were few changes of any import in this week's market reports. Bessemer steel went down to $22.50 at a loss of $0.50 per ton. Lead experienced a drop of $0.02 per 100 pounds, closing at $4.38. Tin dropped to $40.10, after a fluctuating week, closing at a loss of $0.35. Both electrolytic and Lake coppers rose in price, the former $0.00 3-8 and the latter $0.00 1-4 per pound. Cottonseed oil hovered around $6.87 for the week, closing at that price, at a gain of $0.03 per barrel. Tire scrap dropped $0.00 1-8 per pound, closing at $0.08 1-8.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Change
Antimony, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	.06¼	.....
Beams & Channels, 100 lbs.	1.56	1.56	1.56	1.56	1.56	1.56	.....
Bessemer Steel, ton	23.00	23.00	22.00	22.00	22.00	22.50	— .50
Copper, Elec. lb.	.16⅜	16⅝	.16⅝	.16⅝	.16⅝	.16¾	+ .00⅜
Copper, Lake, lb.	.16⅝	.16¾	.16¾	.16¾	.16¾	.16⅞	+ .00¼
Cottonseed Oil, lb.	6.84	6.87	6.88	6.83	6.97	6.87	+ .03
Cyanide Potash, lb.	.19	.19	.19	.19	.19	.19	.....
Fish Oil, Menhaden Brown	.38	.38	.38	.38	.38	.38	.....
Gasoline, Auto, 200 gals.	.22¼	.22¼	.22¼	.22¼	.22¼	.22¼	.....
Lard Oil, prime	.95	.95	.95	.95	.95	.95	.....
Lead, 100 lbs.	4.40	4.35	4.35	4.35	4.40	4.38	— .02
Linseed Oil	.50	.50	.50	.50	.50	.50	.....
Open-Hearth Steel, ton	23.00	23.00	23.00	23.00	23.00	23.00	.....
Petroleum, bbl., Kansas, crude	1.03	1.03	1.03	1.03	1.03	1.03	.....
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	.....
Rapeseed Oil, refined	.66	.66	.65	.65	.65	.65	— .01
Silk, raw Italy	....	5.20	....	....	5.20	5.20	.....
Silk, raw Japan	....	4.10	....	....	4.08	4.13	+ .03
Sulphuric Acid, 60 Baumé	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	40.45	40.80	40.60	40.50	40.25	40.10	— .35
Tire Scrap	.08¼	.08¼	.08¼	.08⅛	.08⅛	.08⅛	— .00⅛

Ten More in M. & A. M.

Membership of Association Is Now 258—New Members To Exhibit at National Shows

NEW YORK CITY, Oct. 15—The following concerns have been elected to the Motor and Accessory Manufacturers. The Cleveland Tanning Co., manufacturer of leather, Cleveland, O.; Racine Manufacturing Co., manufacturer of automobile bodies, Racine, Wis.; Benford Mfg. Co., manufacturer of spark plugs, timers, oil gauges, lighters, screw machine work, etc., Mt. Vernon, N. Y.; Gemmer-Detroit Starter Co., manufacturer of air pumps, garage pumping outfits, air starters, Detroit, Mich.; McGraw Tire and Rubber Co., manufacturer of auto casings and inner tubes, East Palestine, O.; The J. M. Shock Absorber Co., manufacturer of J. M. shock absorbers, Philadelphia, Pa.; F. S. Carr Co., manufacturer of rubberized top and seat cover material, Boston, Mass.; Torbensen Gear & Axle Co., manufacturer of axles, Newark, N. J.; Taylor Instrument Co., manufacturer of thermometers, barometers, hydrometers, motometers, etc., Rochester, N. Y.; The Reynolds-Browne Co., manufacturer of automobile lamps, Chicago, Ill., and the Knight Tire and Rubber Co., manufacturer of tires and inner tubes, Canton, O. These additions make the total membership of the organization to date 258. The new members will exhibit at the shows.

Stephenson Motor Truck Company Bankrupt

MILWAUKEE, WIS., Oct. 22—Special telegram—The Stephenson Motor Truck Co., South Milwaukee, Wis., has been thrown into the hands of a receiver by involuntary bankruptcy proceedings instituted by three creditors whose claims total $300. Insolvency is admitted as no effort has been made to do business since the truck company lost a suit against the Case Threshing Machine Co. several months ago. The former concern claimed $150,000 damages against the Case company for alleged breach of contract in not purchasing the property of the truck company.

Electrical Show Stimulates Sales

NEW YORK CITY, Oct. 20.—Increased sales and new agencies are reported at the vehicle display of the Electrical Show, which opened on October 15. This display includes the newest models of both commercial and pleasure electric automobiles of several companies, with their accessories.

Those concerns manufacturing electric trucks state that the show has brought in out-of-town buyers, and that prospects of increased sales are promising. The General Vehicle Co., Long Island City, N. Y., has made a sale of thirty trucks to Lord & Taylor, of this city, and the Standard Electric Car Co., Jackson, Mich., has established an agency at Marinette, Wis., under the Menominee Light & Power Co., and has also made a sale of two cars. The General Motors Truck Co., Pontiac, Mich., has also established two agencies as a result of the show, one at Newark, N. J., and the other at Paterson.

Importers' Salon Opened to American Cars

NEW YORK CITY, Oct. 22—Several American motor cars are to be included among the exhibits at the 1914 Importers' Automobile Salon, Hotel Astor. This announcement followed a meeting yesterday of the Importers Automobile Alliance. At this meeting five applications on behalf of American built cars for space at the coming Salon were considered and two were accepted. These are the Simplex and the Fiat.

NEW YORK CITY, Oct. 18—A very important meeting of the board of directors of the Automobile Dealers' Assn., Inc., was held recently at its offices in the Hotel Woodward. There were present at this meeting, managers of some of the strongest automobile firms in New York and the purpose of the meeting was the formation of a New York state dealers' association.

S. A. E. to Discuss Cyclecars

NEW YORK CITY, Oct. 22—Cyclecars will be the subject of the October meeting of the Metropolitan Section of the S. A. E., which will be held at the headquarters of the society Thursday evening, October 30, at 8 o'clock. In order to afford ample time for discussion, there will be only a brief introductory, embracing a review of foreign practice in cyclecar construction, followed by arguments in which the advantages of the motorcycle and the present type of small runabout for their respective uses, and as opposed to the cyclecar, will be set forth.

The date of the November meeting will be Wednesday the 26th. The subjects discussed will be Silent and Roller Chains, and Intake and Exhaust Manifolds.

Comet, of Indianapolis, Is Latest Cyclecar Company To Organize

INDIANAPOLIS, IND., Oct. 20.—Organization of the Comet Cyclecar Co. practically has been completed and articles of incorporation will be filed with the Indiana secretary of state in a few days. Provisions are being made to place sufficient capital behind the concern to permit operations on a large scale.

Those interested in the company are St. Clair Parry, E. R. Parry and Marshall T. Levey. The Parrys a few years ago were interested in the Parry Automobile Co. and are now identified with the Parry Mfg. Co. A cyclecar to sell below $400 is to be manufactured by the new concern.

Decimal Point Missing—In the article on electric starting and lighting, by C. S. Cole in THE AUTOMOBILE for October 2, the decimal point was omitted, making it appear that, while it requires .25 horsepower to drive the machine of the Electrical Engineering & Storage Battery Co., Sandy Hook, Conn., at 400 revolutions per minute, it takes 5 horsepower at 2,000 revolutions. The figure should have been .5.

COMPANIES WHICH HAVE JUST SECURED SPACE AT THE NEW YORK SHOW

Allen Motor Co., Fostoria, O.
Asch & Co., Inc., New York City.
Ajax Trunk & Sample Case Co., New York City.
Asbestos & Rubber Works of Am., New York City.
A. R. Justice Co., Inc., Philadelphia, Pa.
American Taximeter Co., New York City.
Automobile Journal Pub. Co., Pawtucket, R. I.
Brown Company, Syracuse, N. Y.
B & L Auto Lamp Co., New York City.
Bock Bearing Co., Toledo, O.
Baush Machine Tool Co., Springfield, Mass.
Peteler Shock Absorber Corp., New York City.
Northway Motor & Mfg. Co., Detroit, Mich.
Miller Rubber Co., Akron, O.
Crescent Motor Co., Cincinnati, O.
Champion Spark Plug Co., Toledo, O.
Cleveland Hardware Co., Cleveland, O.
Rushmore Dynamo Works, Plainfield, N. J.
Rich Tool Co., Chicago, Ill.
J. R. Ashley Co., New York City.
Wm. R. Laidlaw, Jr., New York City.
C. A. Willeys Co., New York City.
Model Gas Engine Works, Peru, Ind.
P. Reilly & Son, Newark, N. J.
Charles E. Miller, New York City.
Frazer Lubricator Co., Chicago, Ill.
Peter A. Frasse & Co., Inc., New York City.
Jones Electric Starter Co., Chicago, Ill.
Universal Lubricating Co., Cleveland, O.
Fentress-Newton Mfg. Co., Detroit, Mich.
Howe Rubber Co., New Brunswick, N. J.
International Metal Polish Co., Indianapolis, Ind.
Fitzgerald Mfg. Co., Torrington, Ct.
Perkins Campbell Co., New York City.
Comumb Tyres Import Co., Inc., New York City.
J. Eavenson & Son, Inc., Camden, N. J.
Havoline Oil Co., New York City.
Johns-Manville Co., New York City.
Chauffeur Pub. Co., Syracuse, N. Y.
Donnelly Motor Equipment Co., New York City.
David Kahnweilers Sons, New York City.
Cox Brass Mfg. Co., Albany, N. Y.
Universal Shock Eliminator, Inc., New York City.
Eveland Engineering & Mfg. Co., Philadelphia, Pa.
Motor Patents Co., Detroit, Mich.
Pyrene Mfg. Co., New York City.
Emil Grossman Co., Brooklyn, N. Y.
Rhineland Machine Works Co., New York City.
New York Coil Co., New York City.
J. Alexander Mfg. Co., New York City.
John T. Stanley, New York City.
Thermoid Rubber Co., Trenton, N. J.
Motor, New York City.
Metal Stamping Co., Long Island City, N. Y.
Wayne Oil Tank & Pump Co., New York City.
S. P. Townsend & Co., Orange, N. J.
Aristos Co., New York City.
L. Sonneborn Sons, Inc., New York City.
Charles O. Tingley & Co., Rahway, N. J.
Baum's Castorine Co., Rome, N. Y.
United & Globe Rubber Mfg. Co., Trenton, N. J.
Platt & Washburn Refining Co., New York City.
H. P. B. Electric Co., Rye, N. Y.
Newmastic Co., New York City.
Thurber Rotary Starter Co., Detroit, Mich.
English & Mersick Co., New Haven, Ct.
Motor Vehicle Pub. Co., New York City.
R. I. V. Co., New York City.
Motor World Pub. Co., New York City.
Nonpareil Horn Mfg. Co., New York City.
Marburg Bros., Inc., New York City.
Horseless Age Co., New York City.
H. H. Franklin Mfg. Co., Syracuse, N. Y.
Motorcycle Pub. Co., New York City.
Berg Auto Trunk & Specialty Co., New York City.
N. B. Arnold, Brooklyn, N. Y.
National Rubber Co., St. Louis, Mo.
Majestic Mfg. Co., Worcester, Mass.
Julian H. Faw, New York City.
Motorcycling, Chicago, Ill.
Eclipse Machine Co., Elmira, N. Y.
Bicycling World Co., New York City.
Standard Woven Fabric Co., Framingham, Mass.
W. H. Brown, Cleveland, O.
Houpert Machine Co., New York City.
Silvex Company, 60 Wall St., New York City.
Detroit Steel Products Co., Detroit, Mich.
Hawthorne Mfg. Co., Inc., Bridgeport, Ct.
Ernst Flentje, Cambridge, Mass.
Essex Rubber Co., Inc., Trenton, N. J.
Golde Patent Mfg. Co., New York City.
Chilton Company, Philadelphia, Pa.
Perfection Spring Co., Cleveland, O.
Class Journal Company, New York City.
Thomas Prosser & Son, New York City.
K-W Ignition Co., Cleveland, O.
L. J. Mutty Co., Boston, Mass.
Ralph Waldt, New York City.
McQuay-Norris Mfg. Co., St. Louis, Mo.
United States Gauge Co., New York City.
Mayo Mfg. Co., Chicago, Ill.
Stevens & Co., New York City.
F. A. Baker & Co., New York City.

To Eliminate Crossings

Missouri and Kansas Public Utilities Commissions Expect To Replace Them with Subways or Bridges in 15 Years

KANSAS CITY, Mo., Oct. 18.—The states of Missouri and Kansas have undertaken the elimination of the grade crossing. In Missouri the state public utilities commission has announced a policy by which in 10 or 15 years all such crossings will have been converted either into subways or overhead viaducts. The commission has employed J. L. Harrup, an expert engineer from Wisconsin, at a salary of $3,600 a year, and he will give his entire time to that work. Already hearings have been held in St. Louis and St. Joseph and several crossings ordered changed. A similar hearing will be held here within the next few weeks.

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INDIANAPOLIS, IND., Oct. 18.—The annual meeting of the Indiana Automobile Assn., a federation of motor clubs throughout the state, was held in Indianapolis October 16. Preston C. Rubush, an Indianapolis architect, was elected president and W. S. Gilbreath, secretary of the Hoosier Motor Club of that city, was elected secretary. There was an extended discussion of the question of employing convict labor in road building, and it was decided to make a thorough investigation of the subject with a view to making recommendations to the Indiana legislature. While the attendance was not large, the meeting was an enthusiastic one, and the results accomplished were very satisfactory

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Hoosier Engineers Hear Prof. Riebe

INDIANAPOLIS, IND., Oct. 20.—There was a large attendance at the first of the series of winter meetings of the Indiana branch of the Society of Automobile Engineers last Tuesday night. The meeting was held in the rooms of the Hoosier Motor Club in this city.

Professor Riebe, recognized as one of the leading German authorities on the subject, read a paper on "The Inspection and Application of Ball Bearings to the Automobile." David Landau, of New York, consulting engineer of the Sheldon Axle Mfg. Co., read a paper on "Some Causes That Influence the Fundamental Deflection of Leaved Springs."

Both speakers revealed an exceptionally deep knowledge of their theme, and, although the second paper was not concluded until midnight, the speakers had no difficulty in retaining the interest of the members. Following the papers refreshments were served.

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Missouri to Train Colored Chauffeurs

ST. LOUIS, MO., Oct. 18.—The State of Missouri has started a school for chauffeurs. The trustees of the Lincoln Institute, a state school for negroes at Jefferson City, this week purchased an automobile in St. Louis. The machine will be taken to the school where the students will be trained in driving and repair work.

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Automobiles Aid Carriage Business

ST. LOUIS, MO., Oct. 18.—That automobiles aid their business rather than hurt it was the assertion of carriage men attending the forty-fifth annual convention of the Carriage Builders' National Association, which adjourned here Thursday. The organization is the oldest in the United States and is exclusively for makers of horse-drawn vehicles.

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Forty-one Makes on Show at Dallas

DALLAS, TEX., Oct. 18.—For the first time in the history of the state fair at Dallas the automobile exhibit is apart from the machinery and other vehicle displays. This year a special building 146 by 290 feet, has been constructed for motor car exhibits. Dealers in Dallas consider that the display at the fair this year will do much to increase sales. Last year sales of cars made through Dallas agencies totaled $12,000,000. By showing the new models with the many improvements that have been made over last year's cars it is believed that even a greater distribution of cars will be made during the present season. In order to get the new automobile building it was necessary for the dealers to split the expense with the fair association. Forty-one makes of cars are on exhibit.

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BOSTON, MASS., Oct. 20.—The annual meeting of the Electric Motor Car Club of Boston was held last week, when the officers for the ensuing year were chosen as follows: Day Baker, president; E. S. Mansfield, vice president; L. L. Edgar, secretary; J. S. Codman, treasurer; Albert Weatherby, chairman, P. J. Stone and A. E. Carpenter, executive committee; Col. E. W. M. Bailey, chairman, J. W. Bowman, R. B. Daggett, W. E. Eldredge, E. A. Gilmore, R. C. Gregg, G. W. Holden, J. C. Mackey, J. L. Morris, F. N. Phelps and J. L. Snow, advisory committee; D. C. Tiffany, chairman, J. W. Emery and L. R. Vredenberg, meetings committee; N. J. Fitch, chairman, R. S. Hale and H. S. Potter, finance committee.

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RACINE, WIS., Oct. 20.—One four and a large and small six are to make up the Mitchell line for 1914. The big six has a 60-horsepower motor and a wheelbase of 144 inches. Other features include left drive, center control and a fully-inclosed T-head motor with tungsten steel valves. Rayfield carbureter and gravity gasoline feed, roomy streamline body, Timken bearings and full-floating rear axle. The small six and the four are similar to the large six except that they have motors of 50 and 40 horsepower respectively.

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Motor Men Take New Positions in the Automobile Field

NEW YORK CITY, Oct. 20.—T. H. Toomey, of the Bellamore-Toomey Co. started Tuesday on an extensive trip through Europe in the interest of several of the large automobile manufacturers of the United States.

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NEW YORK CITY, Oct. 20—K. C. Pardee, Inc., 1860 Broadway, has dropped the Inter State line and taken on the agency for the Havers Six for the Metropolitan district.

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PONTIAC, MICH., Oct. 20—N. E. Wahlberg has been promoted to the position of chief engineer of the Oakland Motor Car Co., Pontiac, Mich.

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NIAGARA FALLS, N. Y., Oct. 18—J. Allen Smith, president of the U. S. Light & Heating Co., has started on his second trans-Atlantic trip of the year. Mr. Smith will not only attend to unfinished and new business, but will endeavor to visit the various automobile shows, which are held earlier in England and Europe than in this country.

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NEW YORK CITY, Oct. 20—The F. R. Wood, W. H. Dolson Co. sold for the International Motor Co. to a client of the Chauncey Real Estate Co. the factory at 532 to 540 Atlantic avenue, Brooklyn. The building was occupied by the Mack Brothers Motor Co., a subsidiary concern of the International company.

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NEW YORK CITY, Oct. 20—The Zimmerman Mfg. Co., Auburn, Ind., has been awarded a Dyer license by the Enterprize Motor Co.

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NEW YORK CITY, Oct. 18—The A. Elliott Ranney Co., eastern agent for the Hudson, has leased the entire fifth floor of the old U. S. Motor Building, 3 West Sixty-first street, for its general offices and service station. The new quarters will have a floorspace of more than 15,000 square feet and will afford ample space to handle between fifty and seventy-five cars at one time.

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HARTFORD, CONN., Oct. 18—Henry W. Nuckols, former president of the Columbia Motor Car Co., has been appointed general assistant to Milton J. Budlong, president of the Packard Motor Car Co., of New York.

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NEW YORK CITY, Oct. 18—Fred E. Dayton has joined the sales forces of the Ajax-Grieb Rubber Co., and will be assistant to J. C. Matlack. Mr. Dayton will have charge of the advertising department.

Two Classes for 1914 French Grand Prix

One Class To Have Unlimited Cylinder Size, Other To Have 274-Cubic Inch Limit

PARIS, Oct. 8.—Two classes will doubtless be provided for in next year's French Grand Prix: (a) machines of a maximum weight of 2,425 pounds without cylinder limitations, and (b) cars having a cylinder area of not more than 4.5 liters (274 cubic inches) and a maximum weight of 2,425 pounds. Class (a) will be known as Grand Prix cars; Class (b) will be designated cylinder trophy cars. The two races will be run together over a distance of 500 to 600 miles, it being quite possible for a car in Class (b) to win the Grand Prix. The arrangement is somewhat similar to that adopted last year at Dieppe, when big cars and 3-liter machines raced together.

These recommendations have been drawn up by the Sporting Commission of the Automobile Club of France. Before becoming official they will have to be approved by the full club committee. As there is no case on record in which the club has refused to endorse the action of the sporting committee, they may be accepted as definite. It will be noticed that the originally proposed limitation of the number of tires has been abandoned. This introduced such a new element that manufacturers were afraid of it. A certain amount of opposition is being made to the no-limit rule. It is pointed out that progress in racing is only made when a definite problem is set the competitors. With no other limitation than weight, tires become the most important factor. In all probability each manufacturer will be allowed to enter five cars. The entry fee will be $600 per car. Entries will close on January 31.

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PARIS, FRANCE, Oct. 9—Lyons has strong hopes of securing the French Grand Prix next year. The silk city is holding an international exhibition during the summer of 1914 and is of the opinion that the national automobile race would form an important additional attraction. The local authorities have offered a subsidy of $20,000 towards the expenses of the race, and have mapped out what appears to be a most desirable course.

The proposed course has been examined and reported on very favorably. It is 24 miles round and if covered 20 times would give the necessary distance of 480 miles. Starting 8 miles south of Lyons, the first leg is straight and easy, the second leg is winding and hilly, and the third leg is a dead straight road of about 12 miles and of a switchback nature. On this portion speeds of more than 100 miles an hour can be attained.

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Many Entries for Los Angeles-Phoenix

LOS ANGELES, CAL., Oct. 20—Shortly after sunrise on the morning of November 3, Cadillac racing car number 1, with Charles Soules at the wheel, will be given the "count" and the 1913 Los Angeles-to-Phoenix road race will be under way.

According to present indications there will be at least twenty or twenty-five cars lined up for the start of the gruelling race. Twelve entrants have already posted checks to cover the entrance fees, and there are a large number of machines being tuned up and groomed for the event.

From Los Angeles the cars will be piloted over boulevards for about 25 miles, after which fair country roads will be encountered. The road to San Diego is good and bad in places, but racing drivers who have been over the route predict that an average rate of speed in excess of 50 miles an hour will be registered during the progress of the race between the start and the checking point at San Diego.

Between San Diego and the border of the desert, a range of mountains will have to be traversed, and many difficult turns will have to be made, which will materially cut down the speed of the cars.

The dreaded Mammouth Wash, a stretch of deep shifting sand almost a mile in length is bound to prove a stumbling block for a number of ambitious pilots, as a car will sink clear to the axle, if the wheels are shoved over out of the beaten track.

In one place there is a stretch of road 14 miles long, over the desert sands, where water is not obtainable, and this section could easily be called "Death Valley the second," as a large number of desert travelers have lost their lives on account of the scarcity of water.

Stopping for an over night rest at Yuma, the drivers will send their cars on over the Colorado the next morning, and the finish of the 1913 Los Angeles-Phoenix race will be made some time during the afternoon.

The next day, a three-event card of races will be staged by the Maricopa Automobile Club at the Phoenix race track, and a purse of $2,700 will be divided among the winners of the events.

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Metallurgique Wins Morocco Test

PARIS, FRANCE, Oct. 8.—Paul Rivierre, driving a 14-horsepower Metallurgique, is the winner of the endurance test through Morocco, having covered the 521 miles in 16 hours 21 minutes, being at the rate of about 31 miles an hour. On the last of the six stages, from Mazagran to Casablanca, Rivierre was first, followed by Picard on a Peugeot, Gachet on Ford, Decourt on D.F.P., and Leblanc on Hupmobile. An N. S. U. and a Berliet abandoned on this stage. The American cars made a good showing. Gachet on a Ford being first in the class of machines selling at not more than $1,200. In the $1,200 to $1,800 class the Hupmobile came second, behind Rivierre's Metallurgique. Picard, on the Peugeot, covered the entire distance, but having started a day late could not be classed. Inadequate clearance and excess weight proved a handicap to several of the European cars.

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American Tractors Win in Argentine

STOCKTON, CAL., Oct. 16.—Cables have just been received by the Holt Manufacturing Company of Stockton, Cal., and Peoria, Ill., advising that the 60-horsepower caterpillar gas tractor, entered in the Argentine traction engine contest, has captured first prize, amounting to $15,000. This is the second year that the caterpillar has won the Argentine contest. This year there were twelve tractors entered by American and foreign manufacturers. The first, second, third and fourth places were secured by American-made machines and fifth place by a French tractor.

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Toledo Club Plans Reliability

TOLEDO, O., Oct. 18.—A reliability run is being planned by the Toledo Automobile club to take place early in November. Asst. Sec. C. C. Thompson stated that great interest is being manifested in the project by Toledo motor car owners. The contest will be run under the sanction of the American Automobile Association and its rules will govern the scores and penalties. Trophies will be hung for those making perfect scores. The route selected for the run which will be a two-day event is to Dayton via Marion and Columbus and return by way of Piqua and Lima. This will give a 209-mile run.

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Many Entries for Birmingham Meet

NEW ORLEANS, LA., Oct. 18.—New Orleans, Atlanta, Nashville and Memphis will enter cars to represent them in the 100-mile race, which is to be run at Birmingham, Ala., October 29. The regulation short distance races also will be run. The meet is in charge of William Donovan, the promoter of the Fourth of July races at Memphis and the recent successful meet at Nashville. John Vertrees, president of the Tennessee Auto Co., Nashville, Tenn., will preside at the meet. Special rates have been granted by the railroads serving Birmingham.

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ST. LOUIS, MO., Oct. 18.—The three-cornered tie for first place in the reliability run of the St. Louis Automobile Club, held October 4, was settled this week by the flip of a coin. A. H. Zucker and Clarence King, Cadillacs, won first place and will cut the trophy in two, each getting half, with Zucker having choice of the halves. Louis Manne, the third person in the tie, took second prize, a gold club emblem watch-fob. Each had a score of 998 out of a possible 1,000 in the touring class. Edward A. Limberg took first money in the roadster class, finishing the 122-mile run in a Locomobile with 994 points.

Factory Miscellany

OLD Thomas Factory in Use—E. L. Thomas, formerly secretary of the E. R. Thomas Motor Car Co., Buffalo, N. Y., is fitting up the extensive manufacturing plant which was occupied by that company until recently and converting it for use as a group of manufacturing and power buildings. The buildings, which are of structural steel and concrete, contain about 200,000 square feet of floor space and will be leased for manufacturing purposes. Electric power and heat will be generated and supplied to tenants as desired. A considerable porportion of the space in the buildings, which are located at Niagara, West Ferry and Breckenridge streets and the New York Central Railroad Belt Line, with exceptionally good switching facilities, has already been contracted for.

Fiat Will Add—The Fiat Auto Co., Poughkeepsie, N. Y., will erect additions to its plant.

Tate Electric Moves—The Tate Electric Co., of Walkerville, Ont., has removed its Toronto office to 163-166 Church street.

Morgan & Wright's New Plant—The Morgan & Wright Tire Co., Detroit, Mich., is planning to erect an addition to afford 40,000 square feet of floor space.

Fayette Co. Erects—The Fayette Motor Car Co., Lexington, O., will erect a new building and will be in the market for machine tools for its repair shop.

Hallett & Co. Builds—H. M. Hallett & Co., Ludington, Mich., capitalized at $1,000,000, will build a plant for the manufacture of automobile polish and furniture.

Biggam Will Erect Plant—The Biggam Engineering Co., Buffalo, N. Y., capitalized at $200,000, will soon erect a plant for the manufacture of automobile parts.

Plant for Bearing Maker—A $25,000 factory building is to be erected in Toledo, O., for W. E. Bock, manufacturer of automobile bearings. The dimensions of the building will be 225 by 60 feet.

Southern Tire To Build—The Southern Tire & Rubber Co., Augusta, Ga., will establish an automobile tire factory of brick construction. It will be 50 by 200 feet, with a daily capacity of 100 tires.

McGraw Tire Enlarges Plant—The McGraw Tire and Rubber Co., East Palestine, O., which recently increased its capital $50,000, has commenced enlarging its plant there, which will increase the capacity of the works 65 per cent.

Evans Co. Selling Lots—The Evans Motor Car Co., Nashville, Tenn., recently sold 341 lots, located on the line of the Gallatin Interurban to the Cumberland River. This sale is an inducement to those who buy to be financially interested in the new factory about to be built by that company. This plant will employ 500 or more skilled mechanics.

The Automobile Calendar

Shows, Conventions, Etc.

Oct. 18-Nov. 2	Dallas, Tex., Automobile Show.
Oct. 21-24	Wichita, Kan., Trans-Mississippi Commercial Congress.
Oct. 24-25	Los Angeles, Cal., Ocean-to-Ocean-Highway Assn. Meeting.
Oct. 25	New York City, Electrical Exposition Motor Show, Grand Central Palace.
Oct. 27-28	Chicago, Ill., Fourth Annual Convention, Electric Vehicle Assn. of America.
Nov. 8-15	Atlanta, Ga., Show, Atlanta Automobile & Accessory Assn.
Dec. 9-10-11-12	Philadelphia, Pa., Fourth American Road Congress, First Regiment Armory.
Dec. 9-12	Philadelphia, Pa., Annual Convention of American Road Builders' Association.
Dec. 11-20	New York City, First International Exposition of Safety and Sanitation, under the auspices of the American Museum of Safety.
Jan. 2-10, 1914	New York City, Importers' Automobile Show, Hotel Astor.
Jan. 3-10, 1914	New York City, Automobile Show, Grand Central Palace.
Jan. 10-16	Milwaukee, Wis., Sixth Annual Show, Auditorium, Milwaukee Automobile Dealers' Assn.
Jan. 24-31, 1914	Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 26-31, 1914	Scranton, Pa., Automobile Show, Automobile Assn. of Scranton.
Jan. 10	Cleveland, O., Show, Cleveland Auto Show Co.
Jan. 31-Feb. 7, 1914	Minneapolis, Minn., Automobile Show.
Feb. 2-7	Buffalo, N. Y., Automobile Show, Buffalo Automobile Dealers' Assn.
Feb. 9-14	Buffalo, N. Y., Truck Show, Buffalo Automobile Dealers' Assn.
Feb. 16-21	Kansas City, Mo., Auto Show.
Feb. 21-28	Newark, N. J., Automobile Show, N. J., Auto Trade Assn.
Feb. 22-March 5	Cincinnati, O., Automobile Show, Cincinnati Automobile Dealers' Assn.
Feb. 23-28	Omaha, Neb., Automobile Show, Omaha Automobile Assn.
Mar. 2-6	Fort Dodge, Ia., Show, Fort Dodge Auto Dealers' Assn.
Mar. 7-14	Boston, Mass., Automobile Show.
Mar. 9-14	Des Moines, Ia., Show, Des Moines Automobile Dealers' Assn.
March 17-21	Boston, Mass., Truck Show.

Race Meets, Runs, Hill Climbs, Etc.

Oct. 25	Hutchinson, Kan., Track Race, J. A. Sloan.
Oct. 27	San Marcos, Tex., Track Race. H. Bradley and H. D. Story.
Nov. 3	Los Angeles, Cal., Road Race to Phoenix, Ariz.
Nov. 4	El Paso, Phoenix Road Race, Maricopa Auto Club.
Nov. 6	Phoenix, Ariz., Track Meeting, State Fair.
Nov. 9-12	Shreveport, La., Track Race, J. A. Sloan.

Foreign

Oct. 17-28	Paris, France, Automobile Show, Grand Palais, 10 days.
Nov. 7-15	London, Eng., Annual Automobile Exhibition, Olympia.

Stoddard Tire Makes Debut—The first tire factory to start operation in Worcester, Mass., began the manufacture of tires there, recently, when C. H. Stoddard began producing what will be known as the Stoddard tires. He has his factory at Exchange and Commercial streets.

Cree Motor Sales Co. Change—447 Jackson street, Milwaukee, Wis., has been leased by the Cree Motor Sales Co. This company will devote its entire attention to the wholesale trade, having turned over the retail business to the newly organized Schwarzburg-Mack Auto Co., of the same address.

Ford Enlarges L. I. Plant—The assembling and service plant of the Ford Motor Co., Detroit, Mich., in Long Island City, N. Y., for the use of the Metropolitan district, has been found inadequate to meet the needs of Ford users. Plans are now under way for an eight-story addition, 325 by 288 feet.

Klaxon Offers $250—The Lovell-McConnell Mfg. Co., Newark, N. J., is offering $250 to be divided into seven prizes for the best seven suggestions as to how to regulate the use of warning signals on automobiles. The offer is being distributed among public schools, state granges, automobile club officials, etc.

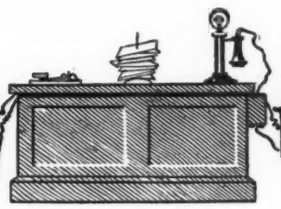
Grant Co. in Dayton—Negotiations have been begun for the removal of the Grant Motor Co.'s plant, now located in Detroit, Mich., to Dayton, O. A 5-acre site adjoining the plant of the Brownell Boiler Works is under consideration. The company is capitalized at $200,000 and has an assembling plant and foundry in Detroit.

Folbert Specialty Co. Builds—The Folbert Auto Specialty Co., Cleveland, O., has purchased a site 105 by 135 feet at West 18th street, that city, and will build a new factory to cover the entire lot. Foundations will be put in to carry several stories, although only one story will be built at present. The company manufactures a line of automobile specialties.

Tire Fillers in Canada—The liquid automobile tire fillers are making a strong bid for Canadian trade. The New Era Tire Treatment Co. is the name of one corporation with headquarters at Princess street, Winnipeg, and Lumsden, Sask. Another company is the Canadian Tire Tonic Co., of Winnipeg, while a third is the Lastic Air Sales Co., Winnipeg. The latter company has its offices on King street.

Penn Plant May Start Up—After standing deserted nearly a year, the $90,000 plant of the bankrupt Penn Motor Co., New Castle, Pa., may be operated again soon, employing 1,000 men. Former general sales agent E. B. Gregg of the defunct company recently obtained a 30 days' lease on the plant and says he expects within 10 days to close a deal whereby the plant will be taken over and operated by an automobile company.

The Week in the Industry



Motor Men in New Roles

SCARRITT New White Manager—W. T. Scarritt is now manager of the White Motors Co., Kansas City, Mo., the former manager, Mr. Goodrich, devoting his time to the Chandler line which this firm has recently acquired in that territory.

Connor Apperson Advertising Manager—J. W. Connor has been made the advertising manager of the Apperson Bros. Automobile Co., Kokomo, Ind.

New Manager for Case Co.—E. C. Beyer has been appointed manager of the Boston, Mass., branch of the J. I. Case Motor Car Co. in place of Mr. England.

Cross Leaves Holley Bros.—C. W. Cross has completed his work with the Holley Bros. Co., Detroit, Mich. No announcement of his future intentions has been made.

Buck Leaves Ford—Glen Buck has retired as advertising manager of the Ford Motor Co., Detroit, Mich. He will devote himself to an extensive advertising business of his own.

Beharrell with Studebaker—A. G. Beharrell, who has been connected with the Boston, Mass., branch of the Velie Motor Veh. Co., has accepted a position with the Studebaker Corp. of Boston.

Newmark Completes 5 Years' Service—J. H. Newmark, advertising manager of the Oakland Motor Car Co., Pontiac, Mich., completed 5 years' service in that capacity on October 18.

Hupp Manager Goes to Europe—C. H. Dunlap, export manager of the Hupp Motor Car Co., Detroit, Mich., left for Paris and London recently, where he will take in the two important motor shows.

Meyer Washington Motz Manager—W. F. Meyer, who has been connected with the Motz Tire & Rubber Co., Akron, O., was recently appointed manager of the Washington, D. C., branch.

Matheson Keeton Purchasing Agent—G. H. Matheson has been appointed purchasing agent for the Keeton Motor Co., Detroit, Mich. He will have his headquarters at the factory in that city.

Challinor New Oakland Manager—A. B. Challinor is the new manager of the Kentucky Motor Car Co., agent in Louisville, Ky., for the Oakland. He succeeds C. W. Hutchinson, who has returned to Cincinnati, O.

Austin Back in St. Louis—H. L. Austin, formerly connected with the tire business in St. Louis, Mo., has returned to that city after an absence of several years spent in New York and will take charge of the tire department of the Fred Campbell Motor Accessory House.

Pollock Locomobile Assistant Manager—M. A. Pollock, until recently advertising manager of the Taylor Instrument Co., of Rochester, N. Y., has been appointed assistant advertising manager of the Locomobile Co. of America, Bridgeport, Conn.

Allen Resigns from Brockville Atlas—R. E. Allen, who has been factory manager of the Brockville Atlas Co., Montreal, for the past year and a half, has severed his connection with that company and has taken up a position in Montreal, Que.

Barker Resigns from Chase—R. M. Barker, who for the last 2 years has been advertising manager of the Chase Motor Truck Co., Syracuse, N. Y., has resigned from that company and accepted a similar position with the Palmer-Moore Co., of that city.

Demar In Own Business—J. E. Demar has gone into business for himself as the Markell Corp., with offices in the United States Rubber Building, New York City. He will act as a manufacturers' agent in the buying and selling of cars and supplies.

Robinson Packard Comptroller—F. R. Robinson, chief accountant of the Packard Motor Car Co., Detroit, Mich., has been appointed to the responsible position of comptroller, and will be the direct representative and assistant to General Manager Alvan Macauley.

Dr. Saylor Goodyear European Manager—Dr. Saylor, who has been vice-president of the Canadian Goodyear Co., has been appointed manager of the Goodyear interests in Europe. He will have general charge of all the company's business in Great Britain and on the Continent and will make his headquarters in London.

Garage and Dealers Field

New Portland Splitdorf Agency—The United Auto Co., of Portland, Ore., has secured the Splitdorf Magneto agency for that city and vicinity.

Motor Supply Compay Moves—The Motor Supply Shops of Boston, Mass., formerly at 883 Boylston street, has moved further up town to 925 Boylston street.

Knight Opens Factory Branch—The Knight Tire & Rubber Co., Canton, O., has opened a direct factory branch at 1528 Grand avenue, in Kansas City, Mo., in charge of E. J. Berry.

Northland Rubber Opens Salesroom—The Nortland Rubber Co., Inc., has opened a salesroom at 1239 Main street, Buffalo, N. Y. J. C. Milson is general manager of sales for this office.

Michigan Moves in Columbus—W. W. Muzzy, manager of the Columbus, O., agency for the Michigan car, has moved into larger quarters at 780 North High street, which was erected for the agency.

Arrol-Johnston Gray & Davis Equipped—Arrol-Johnston, Ltd., of Paisley, Scotland, manufacturer of automobiles, has placed an order with Gray & Davis, Inc., for a large quantity of Gray & Davis starting-lighting systems.

Metz Changes At Boston—The New England branch of the Metz Motor Co., at Boston, Mass., has been moved into the recently vacated salesrooms of the Whitten-Gilmore Co., 993 Boylston street.

New Salesrooms Opened—The Palmer-Singer Motor Co., of Boston, Mass., organized by Walker Burke, formerly with the Michigan Motor Car Co., of that city, has just opened salesrooms on upper Boylston street.

Howe Rubber's Indianapolis Branch—A state and local sales branch has been opened by the Howe Rubber Co., New Brunswick, N. J., in Capitol avenue, Indianapolis, Ind. E. S. Keach is state representative, while B. L. Welsh is manager of the sales branch.

Walpole Company Moves—Owing to the financial difficulties the Walpole Tire & Rubber Co. is involved in the salesrooms on Boylston street, Boston, Mass., has been given up and quarters have been secured at 1 State street, Cambridge, Mass., until the company's affairs are straightened out.

Peerless Co.'s Building Plan—As a part of its policy of building for the future the Peerless Motor Car Co. of Cleveland, O., has adopted a plan of enrollment in its organization every year a considerable number of picked graduates from the leading American technical schools. These engineers are put through a post graduate course of work in the Cleveland factories.

U. S. Tire Moves Offices to N. Y.—The headquarters for its Central District have been moved by the U. S. Tire Co. from Chicago to New York City. The Central District includes everything west of Buffalo and east of Denver and is in charge of Manager C. J. Weston, assisted by G. S. Shugart, R. L. Isams and C. J. Welch, who hereafter will have their offices in the U. S. Rubber Building, Broadway and 58th street.

New Mosler Agencies—The following distributors have been secured by A. R. Mosler & Co., New York City, manufacturers of the Spit Fire spark plugs; Hastings & Anderson, Chicago, Ill.; A. H. Coates, Western representative, E. A. Cassidy & Co., Philadelphia, Pa.; T. A. Cotter, Northeastern representative; A. W. Moyer, factory representative; O. H. Wachtel, New York City; W. R. Ketcham, New York State and Canadian representative, and D. P. Harris Hardware Co., New York City.

Bretz Issues New Bearing List—The J. S. Bretz Co., New York City, has issued a revised list giving dimensions and prices of F. & S. ball bearings of the single annular type. The list is printed on India tinted coated paper and contains tables giving the trade number of the bearings, their bore, outer diameter, width, number and size of balls and increased load capacity in pounds at various r.p.m., as well as the new list prices on both the conventional and the self-aligning type.

Recent Incorporations in the Automobile Field

AUTOMOBILES AND PARTS

BUFFALO, N. Y.—Oakland Distributing Co.; capital, $20,000; to do a general automobile business. Incorporators: Frederick Eaton, Thomas F. Donohue, William C. Grey.

BUFFALO, N. Y.—Star Motor Delivery Co.; capital, $20,000. Incorporators: John B. Corcoran, Wm. H. Corcoran, Richard H. Connor.

CHICAGO, ILL.—Auto Hoist Co.; capital, $50,000; to manufacture machinery. Incorporators: C. J. McGinnis, C. Connelly, T. Monahan.

CHICAGO, ILL.—Dimmer Co. of America; capital, $21,000; to manufacture and sell automobiles, etc. Incorporators: A. A. Pantelis, O. O. H. Weidner, J. H. Lally.

CHICAGO, ILL.—Forest Motor Livery Co.; capital, $5,000; to deal in automobiles. Incorporators: Harnson Kluever, A. O. Baker, Frederick Kluever.

CHICAGO, ILL.—Longwood Automobile Co.; capital, $12,000; to deal in automobiles. Incorporators: A. B. Shaw, W. K. Pattison, R. E. Baker.

CRAWFORDSVILLE, IND.—American Motor Wheel Co.; capital, $600,000; to manufacture automobile trucks and motors. Incorporators: W. H. Owen, S. C. Rowland, J. Vajer Wilson.

DETROIT, MICH.—Cowles-MacDowell Preumobile Co.; capital, $4,000,000; to manufacture automobiles. Incorporators: Irving Cowles, E. H. MacDowell.

EAU CLAIRE, WIS.—Darwin Motor Car Co.; capital, $10,000; to manufacture automobiles. Incorporators: O. S. Darwin, M. D. Garrison, W. C. Tufts.

ELGIN, ILL.—Auto Service Co.; capital, $3,000; to deal in automobiles. Incorporators: Fred Hoagland, E. A. Sowers, Harvey King.

FORT WORTH, TEX.—A. P. Mitchell Auto Co.; capital, $15,000; to deal in automobiles. Incorporators: A. P. Mitchell, E. M. North, E. L. Malone.

LANSING, MICH.—Detroit Cyclecar Co.; capital, $100,000; to manufacture automobiles. Incorporators: Arthur R. Thomas, P. H. Cale.

LIBERTY, IND.—Stanley Motor Co.; capital, $5,000; to manufacture and sell automobiles. Incorporators: R. C. Connor, W. F. Stanley, C. C. Connor.

MASON CITY, IA.—Colby Motor Co.; capital, $6,000,000; to manufacture automobiles. Incorporators: C. H. McNider, P. M. Starness, F. W. Keneston, M. J. Scanlon, S. H. Bowen, W. B. Colby, F. E. Sterns, F. J. Boal, H. M. Waples.

MONTREAL, QUE.—Cadillac Motors, Ltd.; capital, $50,000; to manufacture automobiles. Incorporators: F. G. Bush, H. W. Jackson and others.

MT. VERNON, N. Y.—Chester Hill Motor Car Co.; capital, $1,000. Incorporators: Arthur Levine, Meyer J. Levine, Samuel Levine.

MUNCIE, IND.—B. T. K. Gear and Engine Co.; capital, $100,000; to manufacture automobile engines and gears. Incorporators: F. M. Boyer, Alta Boyer, J. P. Kandel.

NEW YORK, N. Y.—John M. Brissen Co.; capital, $25,000; to do a general automobile business. Incorporators: Thos. F. MacMahon, John M. Brissen, Wm. H. Glover.

NEW YORK, N. Y.—The Markell Corp.; capital, $1,000; to operate an automobile bus line. Incorporators: Arthur B. Graham, Archibald E. Stevenson, Mildred J. Pelikan.

NEW YORK, N. Y.—Welding Supply Co., Inc.; capital, $5,000; to manufacture and deal in motors, vehicles, oxygen-acetylene welding appliances, etc. Incorporators: Walter E. McDonnell, Michael J. McDonnell, A. M. Matheson.

ONEIDA, N. Y.—Oneida Motor Car Co.; capital, $10,000. Incorporators: Frank E. Petrie, Eugene P. Aubeuf, Frank E. Aubeuf.

ROCHESTER, N. Y.—Rochester Motors Co.; capital, $300,000; to manufacture motors. Incorporators: E. F. Davidson, H. Gruelle, E. H. Stearns.

ST. LOUIS, MO.—Sharkey Undertaking and Automobile Service Co.; capital, $4,520; general undertaking and livery business. Incorporators: J. T. Sharkey, J. H. and L. Sharkey.

ST. LOUIS, MO.—Southern Motor Car Co.; capital, $5,000; to deal in automobiles. Incorporator: B. C. Quarles.

TORONTO, ONT.—Amalgamated Motors, Ltd.; capital, $1,000,000; to carry on business as manufacturers, founders and engineers. Incorporators: J. F. Selby, W. H. Smith, T. O. Pardoe.

WASHINGTON, D. C.—Probey-Haynes Motor Co.; capital, $10,000; to deal in automobiles. Incorporators: T. C. Probey, W. D. Arrison and others.

WINDSOR, ONT.—Maxwell Motor Co.; capital, $10,000; to manufacture and deal in automobiles, motors and equipment. Incorporators: W. E. Flanders, W. M. Anthony, E. E. Van Rosen and others.

GARAGES AND ACCESSORIES

CHARLES CITY, IA.—Western Motor Appliance Co.; capital, $25,000; to deal in automobile accessories. Incorporators: G. F. Heitz, Wm. Butz, W. J. Frevert.

DAYTON, O.—Parker Auto Rapid Co.; capital, $5,000; repair of automobiles. Incorporators: G. F. Hall, L. V. Browne, E. R. Marquis, C. C. Hussey, M. N. Browne.

DETROIT, MICH.—Venus Electric Lamp Co.; capital, $2,000; to manufacture lamps, etc. Incorporators: P. T. and Anna Krastin.

MONTREAL, QUE., CAN.—Kelly Springfield Tire Co.; capital, $5,000; to manufacture rubber tires. Incorporators: W. R. Hastings, Robertson Fleet.

NEW YORK CITY—Motor Materials Co.; capital, $100,000; to deal in accessories. Incorporators: F. C. Faring, R. H. Robbins, B. A. Wordemann.

NEW YORK, N. Y.—Suffolk Lubricating Oils & Gasolene Co.; capital, $1,000. Incorporators: Sol Mamorick, Louis Mamorick, Anna Abramson.

PHILADELPHIA, PA.—Mecca Tire Co.; capital, $100,000; to manufacture automobile tires. Incorporators: W. R. L. Fullerton, C. H. Buckley, L. T. Leyton.

PHILADELPHIA, PA.—Quality Rubber & Auto Supply Co.; capital, $25,000; to deal in automobile accessories. Incorporator: F. R. Hansell.

PITTSBURGH, PA.—Prest-O-Ceal Co.; capital, $5,000; automobile accessories. Incorporators: J. M. Reed, K. K. George, R. D. Dalzell.

ST. LOUIS, MO.—S. & H. Puncture Cure Co.; capital, $25,000; to manufacture a fluid for healing punctures called "Seals-a-Hole." Incorporators: Geo. A. Shine, F. G. Smith, H. H. Heckert.

CHANGES OF NAME AND CAPITAL

DENVER, COLO.—M. J. & A. Sales Co.; change of name to Colorado Haynes Co.

ST. LOUIS, MO.—Knight Cycle Co.; change of name to the Buck Gauge Co.

TORONTO, ONT.—Studebaker Sales Agency, Ltd., name changed to York Motors, Ltd.

CINCINNATI, O.—Bond Hill Auto Service Co.; capital increased from $2,000 to $5,000.

CLEVELAND, O.—Delivery Co. of Cleveland; capital increased from $10,000 to $100,000.

ST. LOUIS, MO.—Automobile Sales Co.; capital changed from $5,000 to $10,000.

ST. LOUIS, MO.—Electric Garage and Service Co.; capital increased from $2,000 to $15,000.

New Agencies Established During the Week

PASSENGER VEHICLES

Place	Car	Agent
Akron, O.	Cole	C. H. Shubert & Son
Akron, O.	Haynes	H. E. Kepler
Albany, Ga.	Cole	Owens Auto Co.
Albany, N. Y.	Palmer-Singer	Consalus Auto Co.
Ashland, Ore.	Cole	H. G. Butterfield
Astoria, Ore.	Cole	Nelson Zapf Auto Co.
Bayshore, N. Y.	Oakland	Jacob Finkelstein
Beresford, S. D.	Kisselkar	H. E. Blum
Boston, Mass.	Apperson	Vanerin & Padden Co.
Boston, Mass.	Imp	E. P. Blake
Boston, Mass.	Marathon	Marathon Motor Car Co.
Boston, Mass.	Lozier	Wentworth-Fosdick Co.
Boston, Mass.	Palmer-Singer	E. A. McGrath
Bryan, Tex.	Kisselkar	J. E. Covey & C. M. Cole
Calgary, Alberta, Can.	Cole	Central Garage
Campton, N. H.	Oakland	Miss Carrie E. Royce
Chillicothe, Mo.	Cole	Adams & Son
Cleveland, O.	Detroiter	M. D. Coate
Cleveland, O.	King	R. M. Allen Motor Sales Co.
Cleveland, O.	Kisselkar	Brandt Motor Car Co.
Clinton, Ia.	Kisselkar	C. A. Fay
Columbus, O.	Reo	Broad-Oak Auto Co.
Condersport, Pa.	Kisselkar	M. A. Lawler
Dallas, Tex.	Haynes	Davis-Turney Auto Co.
DeKalb, Ill.	Cole	G. H. Dean & Co.
Denver, Colo.	Haynes	Colorado Haynes Co.
Elwood, Ind.	Haynes	Wilfred Sellers
Emporia, Kan.	Cole	Warren Ellis
Evansville, Ind.	Haynes	Boyd & Kappler
Garner, Iowa	Cole	Garner Automobile Co.
Gastonia, N. C.	Cole	Gastonia Garage Co.
Grand Rapids, Mich.	Kisselkar	J. D. Hess
Greenville, Miss.	Haynes	G. G. Alexander
Hartford, Conn.	Cole	M. J. Bliss
Hastings, Neb.	Kisselkar	E. A. Brandes
Hempstead, N. Y.	Cole	W. T. Hutcheson
Hinckley, Ill.	Kisselkar	W. R. Haish
Honolulu, T. H.	Kisselkar	The Von Hamm-Young Co.
Houston, Tex.	Oakland	Oakland Motor Co.
Houston, Tex.	Palmer-Singer	Peters Bros.
Huntington, L. I.	Cole	Walter Flessel
Indianapolis, Ind.	Chicago	Wild Auto Co.
Indian Head, Can.	Cole	Bingham Implement Co.
Kansas City, Mo.	Chevrolet	Southwest Motor Co.
Kansas City, Mo.	Haynes	J. C. Barcus
Kansas City, Mo.	Oldsmobile	Bond Motor Co.
Keokuk, Ia.	Kisselkar	Smith & Perdew
Kingston, Ont., Can.	Cole	F. A. Bibby
Leominster, Mass.	Oakland	Leominster Garage & Auto Co.
Lowell, Mass.	McFarlan	Howard St. Garage
Minneapolis, Minn.	Columbus	L. W. Pitcher
Minneapolis, Minn.	Firestone-Columbus	L. W. Pitcher
Minneapolis, Minn.	Marion	Bowman & Libby, Inc.
Minneapolis, Minn.	Standard	Barclay Automobile Co.
Montreal, Que., Can.	Cole	Rousseau Bros., Ltd.
Montreal, Can.	Palmer-Singer	M. J. Gadbois
Moro, Ore.	Cole	W. H. Moore
Napoleon, O.	Cole	Rohrs & King
New Castle, Pa.	Kisselkar	E. E. Hileman
New Haven, Conn.	Cole	Bradford Auto Sales Co.
Oblong, Ill.	Cole	Oblong Auto Co.
Ogden, Utah	Cole	Browning Bros. Co.
Ogdensburg, N. Y.	Cole	Charles H. Ashley
Oregon City, Ore.	Cole	Sullivan Bros.
Orwigsburg, Pa.	Oakland	R. H. Diebert
Osceola, Wis.	Kisselkar	M. J. O'Reilly
Oxnard, Cal.	Cole	Crescent Garage & Machine Co.
Oyster Bay, L. I.	Cole	Elbert Tappan
Palouse, Wash.	Reo	Palouse Hardware Co.
Peoria, Ill.	Cole	Cole Motor Co.
Petersburg, Va.	Palmer-Singer	P. H. Booth
Philadelphia, Pa.	Cole	Automobile Co. of Philadelphia
Pittsburg, Pa.	Palmer-Singer	Klingler Co.
Pittsfield, Mass.	Reo	Van Sleet-Schwartz Co.
Plymouth, Wis.	Kisselkar	Torke Bros.
Portage La Prairie, Can.	Cole	A. R. Hoover
Portage, Wis.	Kisselkar	G. H. Bremmer
Port Arthur, Can.	Cole	Tourist Taxi Garage
Portsmouth, O.	Chalmers	W. J. Friel
Rockwall, Tex.	Kisselkar	Newmann Lofland
Rutland, Vt.	Palmer-Singer	R. W. Goodrich
Salem, N. J.	Oakland	G. S. Smith
San Francisco, Cal.	Stearns-Knight	Argonaut Motor Sales Co.
Santa Barbara, Cal.	Cole	H. Wood & Son
Santa Rosa, Cal.	Kisselkar	H. P. Smith, Inc.
Sayville, L. I.	Oakland	Stenger & Rohm
Schenectady, N. Y.	Cole	H. W. Chubb
Seattle, Wash.	Chandler	E. T. Clark
Shelby, Mont.	Cole	James A. Johnson
Silver Creek, N. Y.	Cole	F. B. Porter
Sioux Falls, S. D.	Kisselkar	G. R. Lanning
Springfield, Mass.	Palmer-Singer	Blue Ribbon Garage
Springfield, Mo.	Kisselkar	H. R. Oglesby
Stamford, Conn.	Oakland	Mechalcy Auto Co.
St. Joseph, Mo.	Cole	H. R. Lewis
St. Louis, Mo.	Chase	M. W. Bond Auto Co.
St. Louis, Mo.	Ford	Johnson Automobile Co.
St. Louis, Mo.	Kisselkar	St. Louis Kisselkar Co.
Swift Current, Can.	Cole	J. G. Maxwell
Syosset, L. I.	Oakland	F. B. Whitsen
Tacoma, Wash.	Chalmers	C. A. Taylor
Terre Haute, Ind.	Cole	H. Anderson
Tucson, Ariz.	Kisselkar	Oliver & Howe
Uniontown, Wash.	Reo	J. J. Wells
Vancouver, Wash.	Cole	J. H. Marsh
Venita, Okla.	Kisselkar	Venita Auto Co.
Wellsburg, W. Va.	Cole	Brooke Auto Co.
Westhampton, L. I.	Cole	D. H. Losee
Woburn, Mass.	Buick	Geraghty Motor Co.
Wright City, Mo.	Chevrolet	Nieburg Mfg. Co.
Wright City, Mo.	Reo	Nieburg Mfg. Co.

COMMERCIAL VEHICLES

Kansas City, Mo.	Chase	Motor Sales & Service Co.
Kansas City, Mo.	Studebaker	Thorpe-Allen Motor Co.
Pittsfield, Mass.	Reo	Van Sleet-Schwartz Co.
St. Louis, Mo.	Chase	M. W. Bond Auto Co.
St. Louis, Mo.	Overland	Missouri Motor Car Co.
Waltham, Mass.	Jeffery	Moody St. Garage Co.
Woburn, Mass.	Buick	Geraghty Motor Co.
Woburn, Mass.	Selden	Geraghty Motor Co.

Accessories for the Automobilist

ELECTRICALLY Warmed Gloves—Now that electrical equipment has become so popular and is used in so many ways to make car operation more pleasant the thought that electrically heated gloves may be obtained ought to be of interest to those motorists who drive open cars in cold weather. Incorporated in the lining of each glove is a tough but flexible electrical circuit which terminates on the surface of the forefinger in a small metal disk, and at the other end on the inside of the thumb in a similar disk. When the hand grasps the wheel (Fig. 1) these small disks are brought into contact with thin plates on the upper and under surfaces of the steering wheel, which form the terminals of a wire circuit leading to the storage battery. The circuit is closed by this contact, and the current is led through the lining of the glove across the back of the hand and all of the fingers, the heating effect being obtained by the heat generated by the resistance offered by the wire to the passage of the current. A 6-volt circuit is required. The gloves are made by Carron & Co., Inc., New York City.

Pitner Grease Gun—The Sunderland Mfg. Co., Chicago, Ill., is making a grease gun (Fig. 2) that may be discharged of its contents either by hand or compressed air, the latter being supplied through an ordinary hand pump such as is used for inflating tires or by compressed air line. The air connection is located in the top cap of the gun cylinder. The operation of the gun is as follows: The lower cap is removed and the open end of the gun is thrust into the grease, which is then sucked into the cylinder by pulling up on the piston rod. To empty the gun it is only necessary to apply sufficient air pressure on the back of the piston to move the piston the length of the cylinder. Emptying the grease gun by means of compressed air makes it easy to force grease into places where it would be impossible to find room to operate the piston by hand. A stop cock is provided on the nozzle to shut off the grease whenever desired. The gun is 2 inches in diameter by 10 inches in length and holds 1 pound of lubricant.

Avery Electric-Acetylene Burner—The Acetylite Gas Co., Milwaukee, Wis., is manufacturing an acetylene burner to take the place of electric headlights when the batteries or dynamo fail. Fig. 3 shows how this burner is applied. At A is shown an Edison swan socket, which is attached to the lamp. In this socket is placed B, through which the acetylene goes to the burner D. There is a hose connection to B from an acetylene tank. The flame burns horizontally and in the same focal point that the electric bulb occupied.

Sparton Push Button—The Sparks-Withington Co., Jackson, Mich., has brought out a push button that differs from the ordinary construction in that it sticks out prominently from its casing and may be operated from any angle, due to its broad convex surface. These features are especially desirable to the winter motorist encumbered by heavy gloves. The button is finished in black satin enamel. A cross-section is shown in Fig. 4.

Auto Turn Jack—This device, Fig. 5, as its name implies, is used both for jacking up machines and for turning them or skidding them around in congested garages or repair shops where it would be impossible to move them about in the ordinary way. It is designed to fit under the axle of the car and raises both wheels at once. There is a small handle by which the jack is adjusted to the height of the axle and then the car is lifted off the ground 2 inches by pressing down on the long handle. The jack mechanism is mounted on a three-wheeled truck and directly over the axle of the two large wheels, the smaller wheel is of the castor type to permit of steering, and is connected to the long handle which is used both for guiding the jack and adjusting it to fit the car. The weight is 85 pounds. The price is $25. It is made by the Rub-On Mfg. Co., Buffalo, N. Y.

G. B. Crankshaft Equalizer—A tool for equalizing or truing up by hand the bearings on crankshafts without the use of a lathe or other tools is being sold by the Auto Supply Co., of New York City. This product, called the G. B. crankshaft equalizer, Fig. 6, it is claimed, will true up the bearings of a crankshaft in 3 to 4 hours. If only one or two bearings need

Fig. 5—Auto turn jack. The illustration shows the method of placing it under the axle. A slight pressure on the long handle raises the car

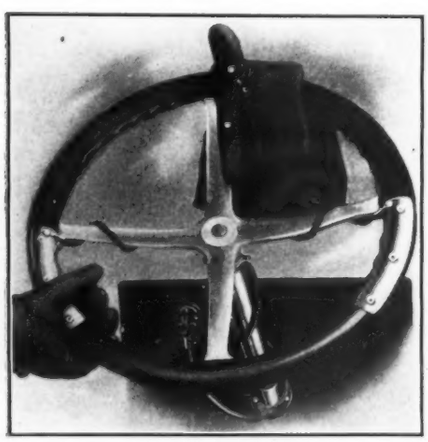


Fig. 1—Carron & Co.'s electrically warmed gloves, showing method of making contact

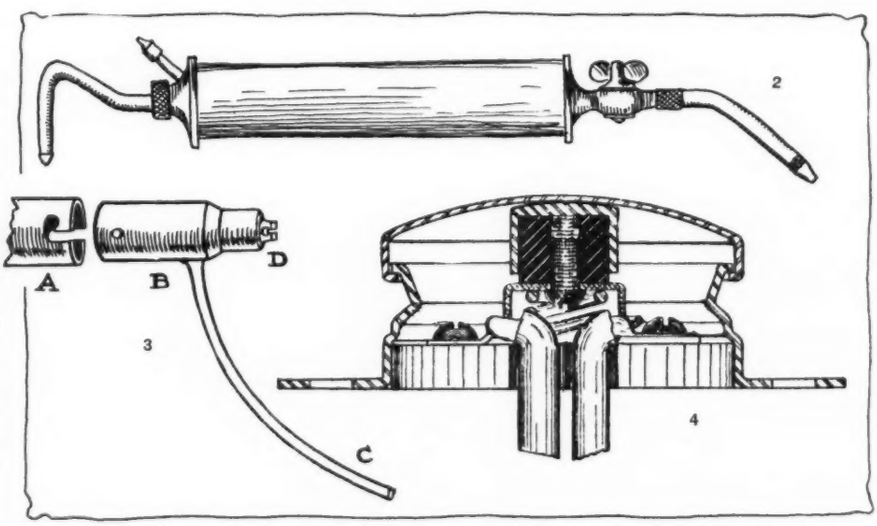


Fig. 2—Pitner grease gun, illustrating air connection. Fig. 3—Avery-Electric acetylene burner, an auxiliary for use when the electric lighting fails. Fig. 4—Sparton push button, a device for the heavily gloved motorist

Index to Automobile Manufacturers Who Have Contracted for

Storage Batteries

A

Abbott Motor Co.....Detroit, Mich.
Adams-Lancia Co. .....New York City.
Allen Motor Car Co.....Fostoria, Ohio.
Alpena Motor Car Co.....Alpena, Mich.
American La France Fire Engine Co..Elmira, N. Y.
American Motors Co.....Indianapolis, Ind.
Ames Motor Car Co.....Owensboro, Ky.
Apperson Bros. Automobile Co.....Kokomo, Ind.
O. Armleder Company.....Cincinnati, Ohio.
Auburn Automobile Co.....Auburn, Ind.
Austin Automobile Co.....Grand Rapids, Mich.
Avery Company, The.....Peoria, Ill.

B

Bartholomew Company .....Peoria, Ill.
Benton Motor Car Co.....Benton, Ill.
L. Berg Carriage Co.....Dallas City, Ill.
Briggs Detroiter Co.....Detroit, Mich.
Buckeye Manufacturing Co.....Anderson, Ind.

C

Canadian Standard Auto & Tract. Co.Fort Wayne, Ind.
Cartercar Company .....Pontiac, Mich.
J. I. Case T. M. Machine Works.....Racine Junct., Wis.
Chadwick Engineering Works.....Pottstown, Pa.
Chandler Motor Car Co.....Cleveland, Ohio.
Colby Motor Co.....Mason City, Ia.
F. Coleman Carriage & Harness Co...Ilion, N. Y.
Commerce Motor Truck Co.....Detroit, Mich.
Corbitt Automobile Co.....Henderson, N. C.
Crane Motor Car Co.....Bayonne, N. J.
Crawford Automobile Co.....Hagerstown, Md.
Crescent Motor Company.....Cincinnati, Ohio.
Crow Motor Car Co.....Elkhart, Ind.
James Cunningham, Son & Co.....Rochester, N. Y.

D

Geo. W. Davis Carriage Co.....Richmond, Ind.
Di Dion Bouton.....New York City.
Dorris Motor Car Co.....St. Louis, Mo.

E

Enger Motor Car Co.....Cincinnati, Ohio.
Elkhart Carriage & Harness Co.....Elkhart, Ind.

F

F. A. L. Motor Car Co.....Chicago, Ill.
F.I.A.T. Company .....Poughkeepsie, N. Y.
Flanders Motor Co.....Detroit, Mich.
H. H. Franklin Manufacturing Co.....Syracuse, N. Y.

G

Gramm Bernstein Company.....Lima, Ohio.
Gramm Motor Truck Co.....Lima, Ohio.
Gramm Motor Truck Co.....Walkerville, Ont.

H

Havers Motor Car Co.....Port Huron, Mich.
Haynes Automobile Co.....Kokomo, Ind.
Henderson Motor Car Co.....Indianapolis, Ind.
Herreshoff Motor Co.....Detroit, Mich.
Hupp Motor Car Co.....Detroit, Mich.

I

Imperial Automobile Co.....Jackson, Mich.

J

Jackson Motor Car Co.....Jackson, Mich.

K

Kelly-Springfield Motor Truck Co.....Springfield, Ohio.
King Motor Car Co.....Detroit, Mich.
Kissel Motor Car Co.....Hartford, Wis.
Kline Motor Car Co.....Richmond, Va.
Knox Automobile Co.....Springfield, Mass.
Krit Motor Car Co.....Detroit, Mich.

L

Lancia Company .....Turin, Italy.
Lenox Motor Car Co.....Boston, Mass.
Lexington Motor Car Co.....Connersville, Ind.
Little Motor Car Co.....Flint, Mich.
Locomobile Co. of America.....Bridgeport, Conn.
Lozier Motor Car Company.....Detroit, Mich.
Lyons Atlas Company.....Indianapolis, Ind.

M

W. H. McIntyre Company.....Auburn, Ind.
McLaughlin Motor Car Co.....Oshawa, Ont.
Marathon Motor Co.....Nashville, Tenn.
Marion Motor Car Co.....Indianapolis, Ind.
Maritime Motor Car Co., Ltd.....St. John, N. B.
Martin Carriage Works.....York, Pa.
Martindale & Millikan.....Franklin, Ind.
Mason Motor Car Co.....Waterloo, Ia.
Maxwell Motor Car Co.....Dayton, Ohio.
Mercer Automobile Co.....Trenton, N. J.
Meteor Motor Car Co.....Shelbyville, Ind.
Metzger Motor Car Co.....Detroit, Mich.
Mitchell-Lewis Motor Car Co.....Racine, Wis.
Moline Automobile Co.....East Moline, Ill.
Motor Car Manufacturing Co.....Indianapolis, Ind.

N

Nance Motor Car Co.....Philadelphia, Pa.
National Motor Vehicle Co.....Indianapolis, Ind.
Nordyke & Marmon Co.....Indianapolis, Ind.
Norwalk Motor Car Co.....Martinsburg, W. Va.
Nova Scotia Carriage Co.....Kentville, N. S.
Nyberg Automobile Works.....Anderson, Ind.

P

Packard Motor Car Co.....Detroit, Mich.
Paige-Detroit Motor Car Co.....Detroit, Mich.
Palmer & Singer Manufacturing Co..Long Island City, N. Y.
Paterson Wagon Works.....Flint, Mich.
Peerless Motor Car Co.....Cleveland, Ohio.
Pilot Motor Car Co.....Richmond, Ind.
Pope Manufacturing Co.....Hartford, Conn.
Premier Motor Car Co.....Indianapolis, Ind.
Pullman Motor Car Co.....York, Pa.

R

Regal Motor Car Co.....Detroit, Mich.
Renault-Frerers Selling Co.....New York City.
Reo Motor Car Co.....Lansing, Mich.
Reo Motor Car Co. of Canada.....St. Catharines, Ont.
Russell Motor Car Co.....West Toronto, Ont.

S

Sayers & Scovill Co.....Cincinnati, Ohio.
Seagrave Company .....Columbus, Ohio.
Selden Motor Car Co.....Rochester, N. Y.
Simplex Automobile Co.....New Brunswick, N. J.
A. O. Smith Company.....Milwaukee, Wis.
South Bend Motor Car Works.....South Bend, Ind.
Spaulding Manufacturing Co.....Grinnell, Iowa.
Speedwell Motor Car Co.....Dayton, Ohio.
Stafford Motor Car Co.....Kansas City, Mo.
Stanley Motor Car Co.....Newton, Mass.
Staver Carriage Co.....Chicago, Ill.
F. B. Stearns Co.....Cleveland, Ohio.
Stegeman Motor Car Co.....Milwaukee, Wis.
Sternberg Manufacturing Co.....Milwaukee, Wis.
Stevens Duryea Co.....Chicopee Falls, Mass.
Stoddard Dayton Co. (Maxwell).....Dayton, Ohio.
Studebaker Corporation .....Detroit, Mich.
Stutz Motor Car Co.....Indianapolis, Ind.

U

U. S. Carriage Co.....Columbus, O.

V

Vandewater & Company.....Elizabeth, N. J.
Velie Motor Vehicle Co.....Moline, Ill.

W

Wayne Works .....Richmond, Ind.
Webb Company .....Allentown, Pa.
Westcott Motor Car Co.....Richmond, Ind.
Wichita Falls Motor Co.....Wichita Falls, Tex.
Willys Overland Co.....Toledo, Ohio.
Winton Motor Car Co. .....Cleveland, Ohio.

Z

Zimmermann Manufacturing Co.....Auburn, Ind.

WILLARD STORAGE BATTERY CO.
CLEVELAND, OHIO

truing the work can usually be done without removing the crankshaft from the motor. It is only necessary to remove the bottom of the crankcase, drop the bottom half of the crank arm and adjust the tool. The directions are as follows: take out pins 1 and 2, pull tool apart and fix the crankshaft, replacing the pins; screw down adjusting screws 3 and 4 until light but firm contact with the shaft is established; adjust steel roller by screw 5 until same touches shaft lightly and screw down 6 to cutting position and turn tool steadily and slowly. This tool is made in two sizes; the larger size, No. 1, will take shafts from 2 inches to 3.5 inches. The smaller size, No. 2, is for shafts 1.5 inches to 2.5 inches.

Dann Oil Cushion Spring Insert—Lubrication of the leaves of the automobile spring has always been a problem for the car owner, and were it not for the annoying squeaks which rusty leaves give forth and the attendant stiffness due to the partial rusting together of the leaves, preventing them from working freely, he would not concern himself with trying to get oil between them. Realizing the need for some sort of a permanent lubricating feature for spring leaves, the Dann oil cushion spring insert was devised and is now being placed on the market, C. Sklarek, formerly with the Borland-Grannis Co., Chicago, Ill., being sales manager of the Dann Oil Cushion Spring Insert Co., 2246 Indiana Ave., Chicago, the selling company. The Dann insert is a perforated strip of metal designed to go under the spring leaf from tip to tip as shown in Fig. 7. It is made of a special alloy steel and very ductile, possesses anti-friction properties and to a certain extent is non-crystallizing to prevent cracking under continual bending in service, it is claimed. The perforations in the strips are filled with a special lubricant which is a long-fibrous grease having a tendency to stay in the holes. After the strips are placed between the leaves and the leaves then drawn together with the center bolts and clips, the pockets in the inserts are sealed and hold the lubricant in place against any pressure tending to squeeze it out, according to the concern's claims. For the trade, the insert material is manufactured in 1,000-foot lengths and in all standard widths from 1 1-4 inch up. A completely equipped six-leaf spring is increased in thickness about 1-8 inch by the inserts.

Universal Auto Turntable—A steel turntable, Fig. 8, for garages is offered to the public by the Canton Foundry & Machine Co., Canton, O., under the name of the Universal Auto Turntable. Its special feature is that a pit of only 12 inches in depth is required to install it. The superstructure is of structural steel built in truss form and reinforced to give the greatest possible strength. The top plates, which are twelve in number, are made from No. 7 gauge steel and surround a checkered iron removable center. Normally the table is supported by a race of ball bearings about 4 feet in diameter, but when a car is run on it the deflection due to the unbalanced load brings into play a set of rollers at the rim. This construction makes the table especially easy to turn, as most of the load is carried on the ball race and only the unbalanced part by the rollers. The only foundation necessary is a circular concrete base, perfectly level and slightly larger than the turntable. A drain is provided in the center of the pit to which water is led by suitable grooves in the concrete base. If it is desired to use the turntable as a washrack adequate drainage is provided by making an annular trench around the periphery of the table, which is covered by easily removable gratings to facilitate cleaning. This device is built in four sizes, for wheelbases from 108 to 156 inches.

Gun Metal Finish—The favor with which black finished metal trimmings on automobiles are meeting has created a demand for easily applied solutions that will enable the owner to change lamps and other brass parts from a light to a dark finish. The Gun Metal Finish Co., Decatur, Ill., are marketing chemical finishes for this purpose. One of these, called the Bright Finish, when applied to brass causes it to turn black and on a subsequent coating of special enamel, which is supplied with the finish, combines with it, causing a hard surface that is unaffected by heat.

The same concern also furnishes a dull gun metal finish which is especially suited to the body of lamps where a good contrast can be obtained by having the rims and edges in bright nickel or brass finish. The surface produced by this finish resembles rubber. The chemical is applied with a brush and it is claimed that no cracking or peeling can take place, even if the metal is bent.

A substitute for baked enamel is also manufactured by this company. This produces a highly glossed surface. The price of these finishes is $2 per pint, a quantity which is ample for any car.

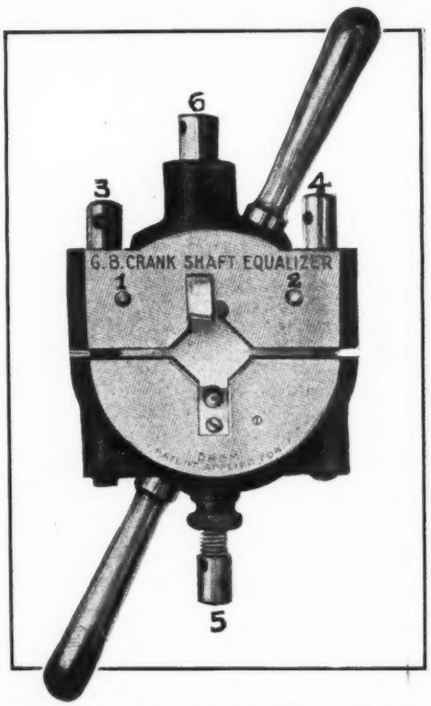


Fig. 6—The G. B. crankshaft equalizer, for truing up by hand the bearings on crankshafts without the use of a lathe or other machine tools

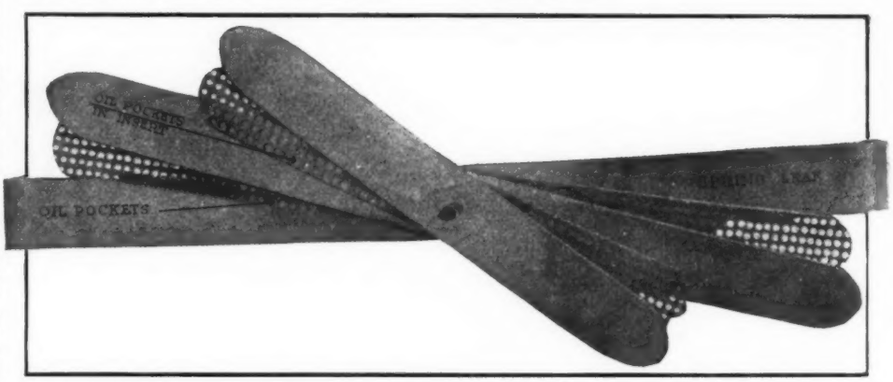


Fig. 7—Dann oil cushion spring insert; the illustration shows how the perforated metal strips are inserted between the leaves of a spring. A hard, fibrous lubricant is carried in the holes in these inserts

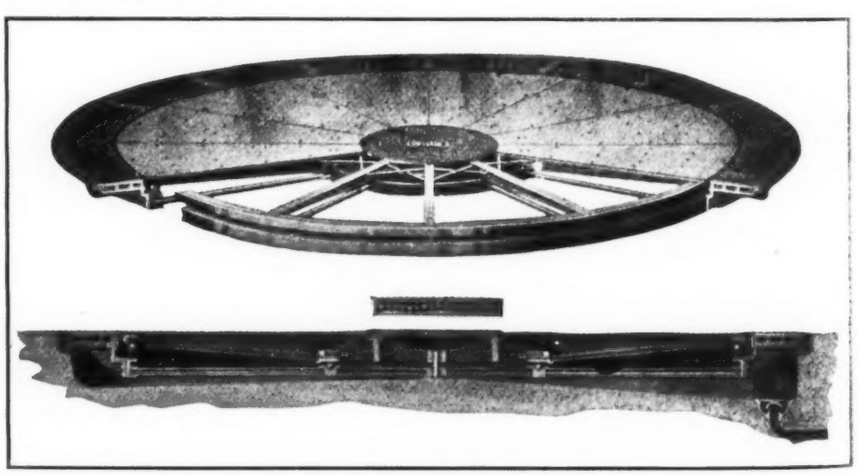


Fig. 8—Universal auto turn table; top in perspective, showing table construction; cross-section gives the position of the roller and ball bearing races and the method of putting in the foundation and drain